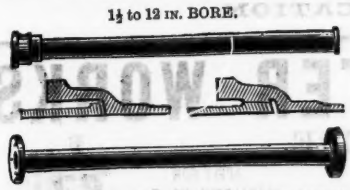
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXV. No. 1664.] LONDON, APRIL 2, 1895. [47TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1½ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.
GLASGOW OFFICE 24, GEORGE SQUARE.
Telegrams:
"BONLEA, STOCKTON-ON-TEES."
"SPRINGBANK, GLASGOW."

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

WOLSTON'S
TORBAY PAINTS
Special Quotations to Gas Companies.
DARTMOUTH, DEVON.

Lanemark Coal Co.,
LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY,
NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

CLOTH CASES FOR BINDING VOLUMES OF THE "JOURNAL" CAN BE HAD OF THE PUBLISHER, PRICE 2s. EACH.

CUTLER'S PATENT TUBULAR GAS CONDENSER SUITABLE FOR GASWORKS OF ALL SIZES, AND FOR ANY CLIMATE OVER 100 ERECTED

TANKS MAKERS OF GASHOLDERS ROOFS
OF EVERY SIZE AND TYPE

HUNT'S PATENT WASHER, IS THE ONLY APPARATUS NECESSARY BETWEEN THE CONDENSER & PURIFIERS, IT REQUIRES NO MOTIVE POWER

TELEGRAMS "RETORTUS" LONDON
NATIONAL TELEPHONE 5059.

S. CUTLER & SONS, MILLWALL LONDON

AGENTS FOR THE "MAXIM" CARBURETTER, A MOST SUCCESSFUL ENRICHER, BY WHICH THE USE OF CANNEL COAL IS AVOIDED AND ALL TROUBLES WITH NAPHTHALENE OBVIATED

FOREIGN AGENTS. ELECTRIC FITTINGS.

IMPROVED SYSTEM OF CARBURETTED WATER-GAS PLANT PARTICULARS ON APPLICATION.

COLONIAL AGENTS. DYNAMOS MOTORS.

CUTLER'S FREEZING PREVENTER IS THE BEST APPLIANCE, FOR PREVENTING FORMATION OF ICE IN GASHOLDER CUPS, IT IS IN USE AT MANY IMPORTANT WORKS IN ENGLAND, GERMANY, AUSTRIA, AND AMERICA.

SAWER & PURVES, Garratt St. Works, MANCHESTER,

MANUFACTURERS OF

IMPROVED WET GAS-METERS IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

IMPROVED DRY GAS-METERS.

Speciality: PATENT CASH PREPAYMENT METERS.

CATALOGUE SENT ON APPLICATION.

PUMPS FOR GAS & WATER WORKS.

FIRST AWARDS EVERYWHERE.

TELEGRAMS: "EVANS WOLVERHAMPTON."

APPLY FOR CATALOGUE NO. 8.

TRADE MARK. LION

(No Trappets.)

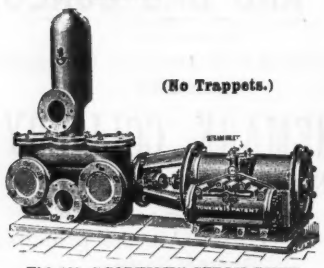


Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

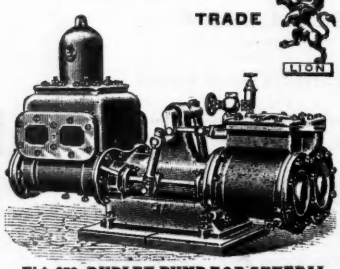


Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

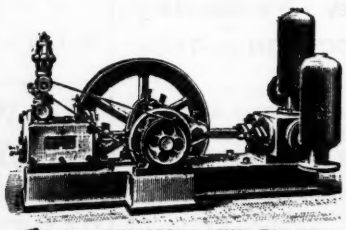


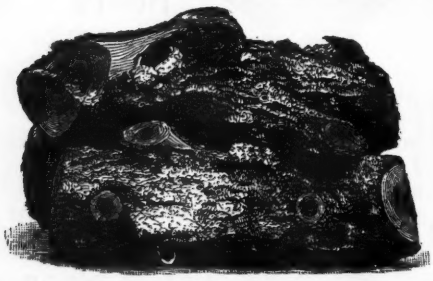
Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

Fig. 708. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

JOSEPH EVANS & SONS, Hydraulic Engineers,

WOLVERHAMPTON. LONDON OFFICE: 16, Union Court, Old Broad Street, E.C.

GAS-FIRES.



The LOG WOOD Gas-Fire.

COMPACT, CLEAN, AND CHEERFUL.

Two Sizes—viz., 14 in. and 16 in. long.

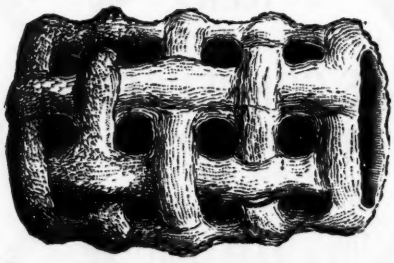
These **GAS-FIRES** are made in one piece, and of Fire-Clay, and have the exact resemblance of **Genuine Logs of Wood.**

They have perforated holes, and when lighted have the remarkably striking appearance of

BURNING LOGS OF WOOD.

They are easily fixed, simply requiring to be connected to an ordinary gas-pipe, or by means of a flexible tube enabling them to be placed in the grate or on tiles.

They fit almost any grate, and have a remarkably **cheerful appearance**, calling to mind the old-fashioned Log-Wood Fires of our forefathers.



NEW REGISTERED

BASKET PATTERN

ASBESTOS FUEL.

This Pattern Fuel has been specially designed and registered, and can be confidently recommended as the **most Efficient Gas Fuel in the Market.** Each piece has **24** holes (about twice as many as any other pattern). The increased quantity of holes giving a greater draught, the fuel is therefore heated quicker. It is also cleaner and neater in appearance than any other pattern.

Complete Catalogue and Prices on application (the Trade only).

FALK, STADELMANN, & CO., LD.,

VERITAS LAMP WORKS,

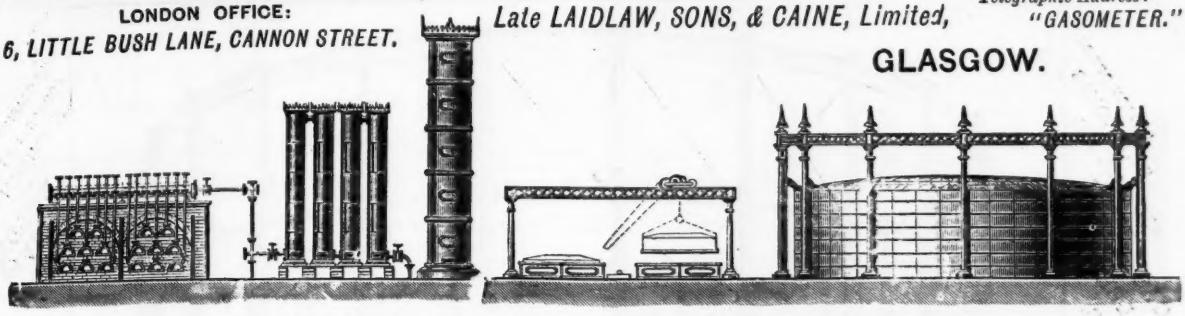
83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

THE BARROWFIELD IRON-WORKS, LIMITED,

LONDON OFFICE:
6, LITTLE BUSH LANE, CANNON STREET.

Late LAIDLAW, SONS, & CAINE, Limited,
GLASGOW.

Telegraphic Address:
"GASOMETER."



MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES
CONDENSERS, EXHAUSTERS, AND ENGINES; SCRUBBERS, WASHERS;
PURIFIERS, WITH PLANED AND CEMENT JOINTS;
DRY AND HYDRAULIC CENTRE-VALVES;
HYDRAULIC AND HAND-POWER LIFTING APPARATUS;
GASHOLDERS, SINGLE-LIFT & TELESCOPE; CAST & WROUGHT IRON TANKS;
STATION METERS; GOVERNORS; SCREW AND RACK VALVES;
FOUR-WAY COCKS AND HYDRAULIC VALVES;
CAST-IRON GAS, WATER, & STEAM PIPES & CONNECTIONS; WROUGHT-IRON TUBES & FITTINGS;
IRON ROOFING, MARKET BUILDINGS, BRIDGES, GIRDERS, STEAM BOILERS;
PROMENADE PIERS AND LOADING WHARVES.

MANUFACTURERS OF OIL PLANT OF EVERY DESCRIPTION.

HENDERSON'S Patent Retorts, Condensers, Stills, Cast and Wrought Iron Tanks, Ammonia Stills, Wrought-Iron Gas-Mains, &c., &c.

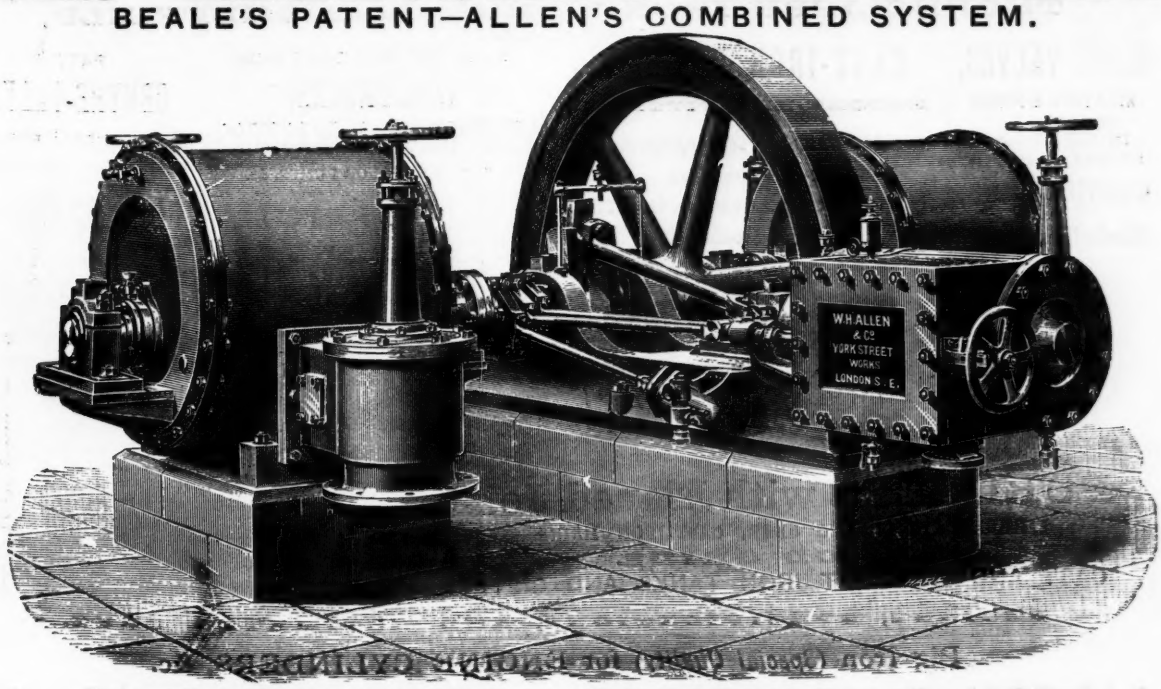
DESCRIPTIVE SPECIFICATIONS AND ESTIMATES ON APPLICATION.

W. H. ALLEN & CO.,

YORK STREET WORKS, LAMBETH, LONDON, S.E.,
And of QUEEN'S ENGINEERING WORKS, BEDFORD,
MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.

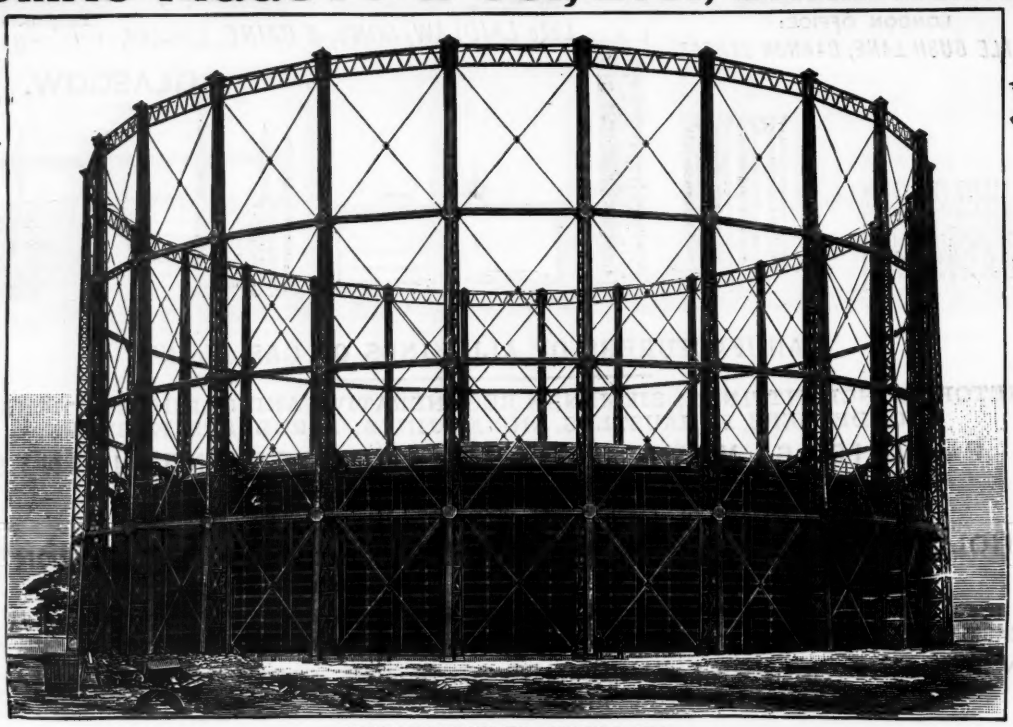


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT-LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS SOLELY OF

HUMPHREYS & GLASGOW'S PATENT CARBURETTED WATER-GAS PLANT.

HAS ALREADY BEEN SUPPLIED TO GAS-WORKS AT

COPENHAGEN, BRUSSELS, GLASGOW, BELFAST, LIVERPOOL, TOTTENHAM, and is in course of Erection now at BELFAST (Second Contract), SWANSEA, BRIGHTON, and PRESTON.

Inquiries to be sent to the Patentees: 9, VICTORIA STREET, LONDON, S.W.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

NEWTON, CHAMBERS, & CO., LIMITED

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

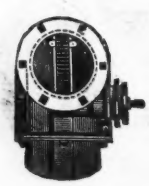
MANUFACTURERS OF

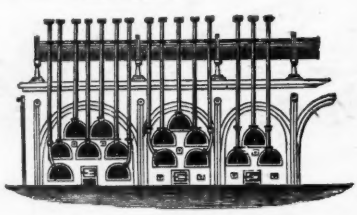
SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS of all sizes.
GASHOLDERS,
AND
Gasholder Tanks.

CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates
and Tools, &c.

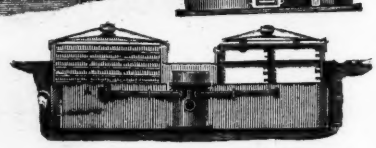
WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.

PATENT
CENTRE-VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves.





PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

ANNOUNCEMENT.

BEAR CREEK CANNEL

We have opened a permanent LONDON OFFICE at

SUFFOLK HOUSE, LAURENCE POUNTNEY HILL, CANNON ST., E.C.

Mr. WM. J. WILSON will be our Representative. We thank our friends for past favours, and solicit a continuance through Mr. Wilson.

THE LOG MOUNTAIN COAL, COKE, & TIMBER COMPANY,
F. A. HULL, President.

PREVENT YOUR GASHOLDER CUPS FROM FREEZING

BY USING

CLAYTON'S

IMPROVED ANTI-FREEZING APPARATUS

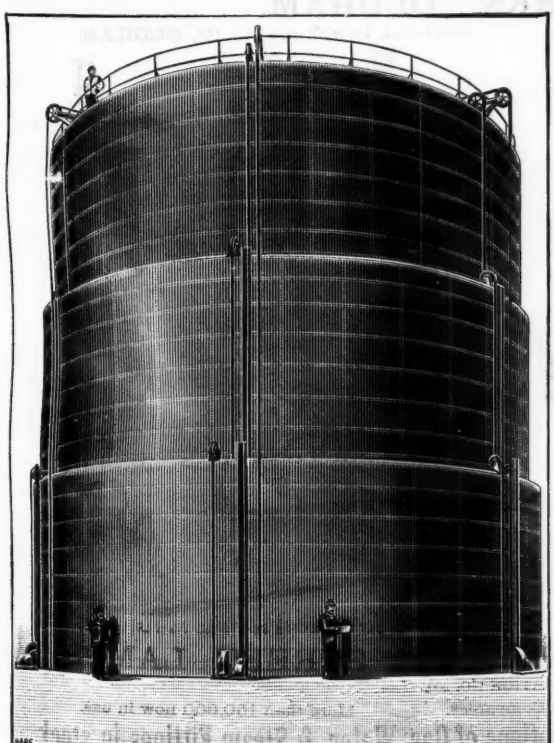
It is the CHEAPEST, SIMPLEST, and MOST EFFECTIVE in the Market.

CLAYTON, SON, & CO., Ltd., Gasholder and Boiler Works, HUNSLET, LEEDS

ASHMORE, BENSON, PEASE, & CO., LIMITED,

GAS-WORKS CONTRACTORS,

STOCKTON-ON-TEES.



From Photo. of Three-Lift Roped Holder, 50 feet diameter by 18 feet deep each Lift. Erected at Sligo, 1894.

Pease's Patent Roped Gasholders

THESE HOLDERS HAVE WORKED SUCCESSFULLY UNDER EVERY TEST TO WHICH THEY HAVE BEEN SUBJECTED SINCE 1889.

MAY BE SEEN AT MANY PLACES.

Send for Catalogue if requiring increased Storage.

The security afforded by this System is shown by the working of the Three-Lift Holder, the subject of this engraving; not only was the Holder unaffected by the recent heavy gales, but also the recorded strain on the Ropes was remarkably small.

London Office: 15, VICTORIA STREET, S.W.

Telegrams { "GASHOLDER, STOCKTON-ON-TEES." "APPARATUS, LONDON."

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

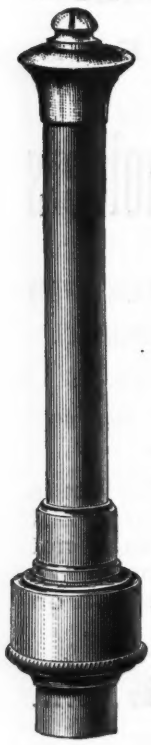
Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

GEORGE ORME & CO.,

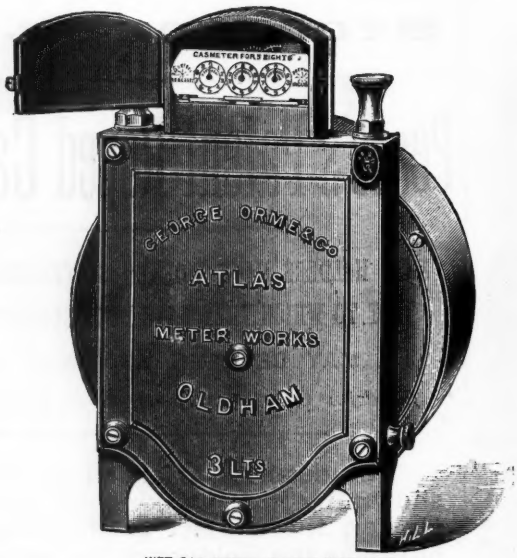
MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS

ATLAS METER WORKS, OLDHAM.

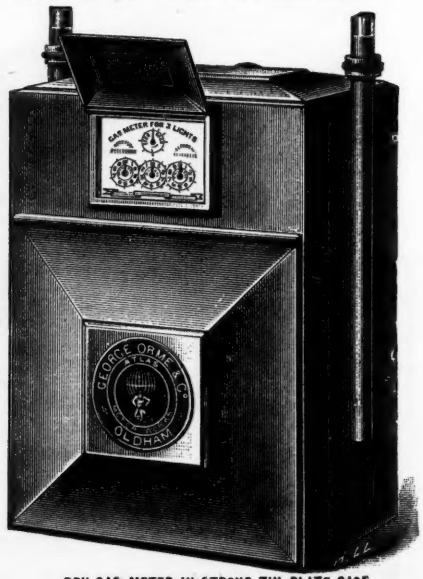
Telegraphic Address: "ORME OLDHAM." **National Telephone No. 93, OLDHAM.**



No. 200.



WET GAS-METER IN CAST-IRON CASE.



DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR FOR STREET LAMPS.

AS ILLUSTRATION NO. 200.

Adopted by the leading London and Provincial Gas Companies: **More than 150,000 now in use.**

Main Gas Cocks, Pressure Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

Illustrated Price Lists and full Particulars on application.

INCANDESCENT GAS-LAMPS

Welsbach Patents.

Great Reduction in Prices

Due to Colossal Sales.

Now supplied at 10/6 Complete.

Important Notice.

Owing to the **unexpectedly large sales** of the Incandescent Gas-Light Burners, the Company are now in a position to offer these to the public at a **considerably Reduced Price**; thus bringing the unquestionable advantages of this System within the reach of the most moderate incomes.

At the higher price, we claimed with justice that the initial cost of the burner was covered by the saving in gas in twelve months, or less. We can, with equal justice, claim that at the **Reduced Price** this saving is effected in **eight months, or less.**

THREE PATTERNS OF INCANDESCENT GAS-LIGHT BURNERS ARE NOW SUPPLIED.

The Ordinary "C" Burner	**Price 10s. 6d.**
The "C" Bye-Pass Burner	**„ 12s. 6d.**
The "S" Bye-Pass Burner	**„ 12s. 6d.**

Mantles will be supplied as heretofore at the reduced rate of 1s. 3d. for use with the Burner supplied by the Company.

PUBLIC WARNING.

The Mantles manufactured by the Incandescent Gas-Light Company can only (as provided by the terms of the limited licence granted with each Mantle) be lawfully used on Burners of the Company's own manufacture. Any person who sells one of the Company's Mantles with, or for use on, any other Burner, and any one of the public who uses one of the Company's Mantles on any Burner not of the Company's manufacture, will render himself liable to proceedings for **Infringement of the Company's Patents.** All persons are therefore warned against having anything to do with Burners not bearing the name of the Incandescent Gas-Light Company stamped upon them.

The *Lancet* pronounces the Incandescent Gas-Light to be the HEALTHIEST, BEST, AND MOST ECONOMICAL SYSTEM OF GAS LIGHTING.

COPY OF FULL REPORT SENT GRATIS ON APPLICATION.

For further Particulars, apply to—

The INCANDESCENT GAS-LIGHT CO.

LIMITED,

PALMER STREET, WESTMINSTER, LONDON, S.W.

JOSEPH CLIFF & SONS,

INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

TELEGRAPHIC ADDRESS:
"ROBUSTNESS, LONDON."

GAS & WATER WORK.

J. & H. ROBUS,

ENGINEERS & CONTRACTORS,
120, BUCKLERSBURY LONDON, E.C.

Furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,

INCLUDING

MAIN LAYING

EXCHANGE TELEPHONE 1756.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

THE CONTINUOUS

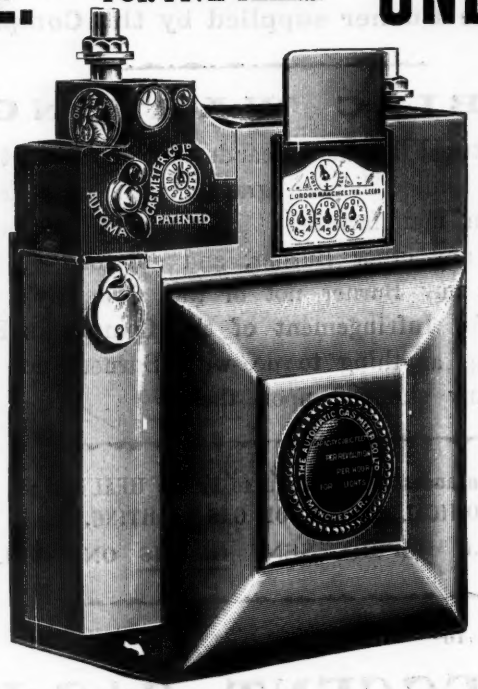
UNFAKEABLE. GUARANTEED FOR FIVE YEARS. **UNBREAKABLE.**

ADVANTAGES.

Every part is interchangeable.

Cannot be tampered with.

Cannot be broken by Hand or Coin Pressure.



ADVANTAGES.

Automatic Mechanism can be taken entirely to pieces, without interfering with Meter, in a few minutes.

The Coins are absolutely in accord with the Registration of the Meter.

Full Information will be sent on application to:—

THE AUTOMATIC GAS-METER COMPANY, LTD.,

49, QUEEN VICTORIA ST., LONDON. | 1, UPPER BROOK ST., and 6, ROSAMOND ST. EAST, MANCHESTER. | 5, MERRION STREET, LEEDS.

WEST'S GAS IMPROVEMENT COMPANY, LTD.,

ALBION IRON-WORKS, MILES PLATTING MANCHESTER.

AND

104, Queen Victoria St.,

LONDON, E.C.

WEST'S

MANUAL

AND

POWER

MACHINERY

FOR

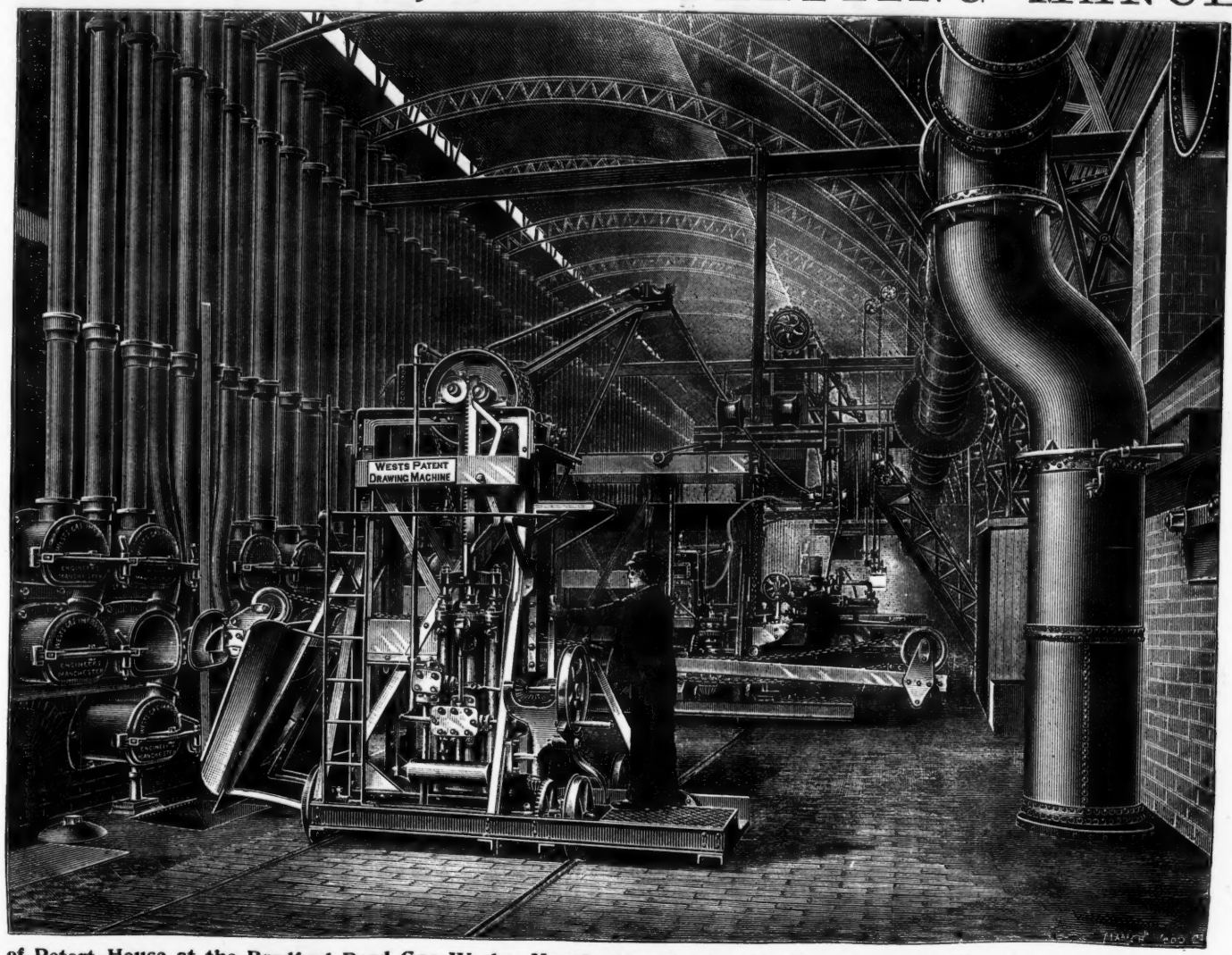
CHARGING

AND

DRAWING

GAS-

RETORTS.



Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

AND

104, Queen Victoria St.,

LONDON, E.C.

OVER

560,000

LINEAL

FEET

OF

RETORTS

DAILY

ARE CHARGED

AND DRAWN BY

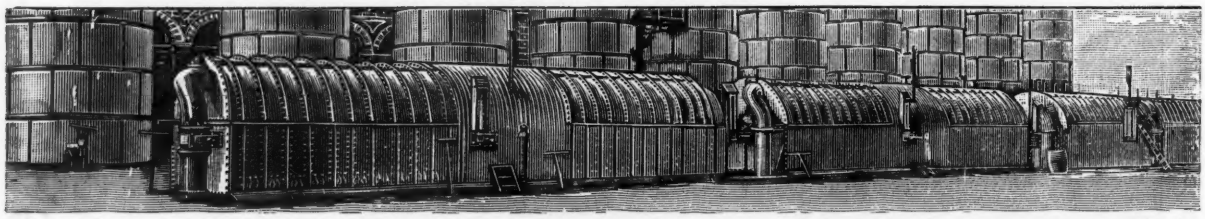
WEST'S

MACHINES.

KIRKHAM, HULETT, & CHANDLER, LD.

PATENT "STANDARD" WASHER-SCRUBBER

☞ **484** of these Machines (capable of dealing with **464,490,000** cubic feet of Gas daily) in use which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have 30 of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

Sole Agents in Great Britain for Marshall's Patent Tar-Extractor.

Address: 3 & 4, Palace Chambers, Bridge St., Westminster, S.W.

JAMES & WILLIAM WOOD, Limited,

GAS COAL AND CANNEL CONTRACTORS AND EXPORTERS,

57, GRACECHURCH ST., LONDON, E.C.

Registered Office—28, ROYAL EXCHANGE SQUARE, GLASGOW.

R. LAIDLAW & SON

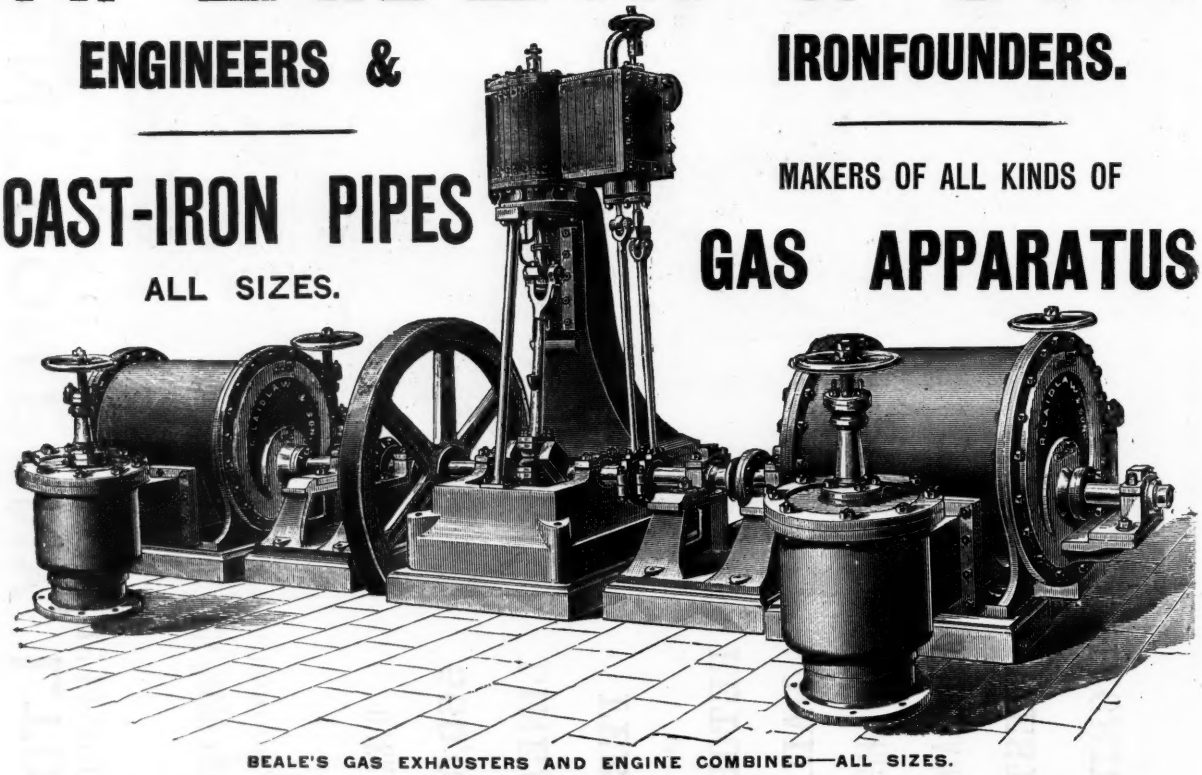
ENGINEERS & IRONFOUNDERS.

CAST-IRON PIPES

ALL SIZES.

MAKERS OF ALL KINDS OF

GAS APPARATUS



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED—ALL SIZES.

ALLIANCE FOUNDRY **GLASGOW.** | SIMON SQUARE WORKS **EDINBURGH.** | 6, LITTLE BUSH LANE **LONDON, E.C.**

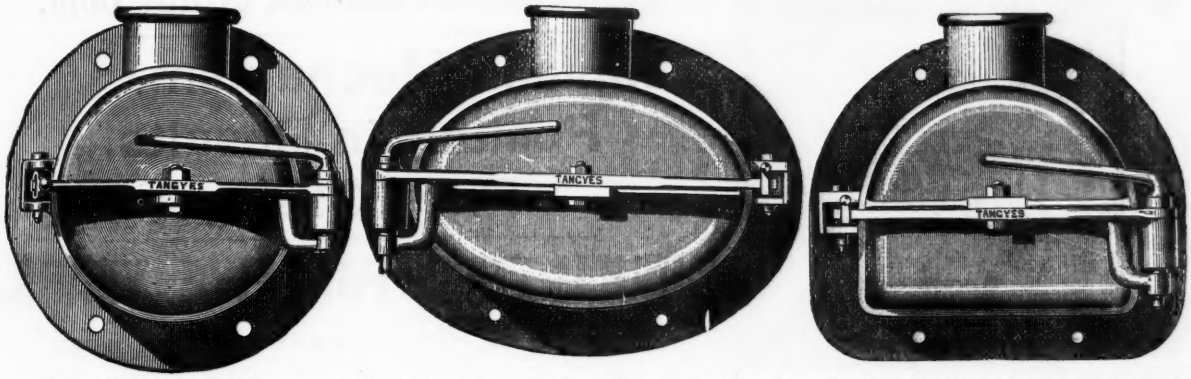
TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM;

AND AT

LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, JOHANNESBURG, BILBAO, ROTTERDAM, & BELFAST.

MORTON'S SELF-SEALING RETORT-LID,

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



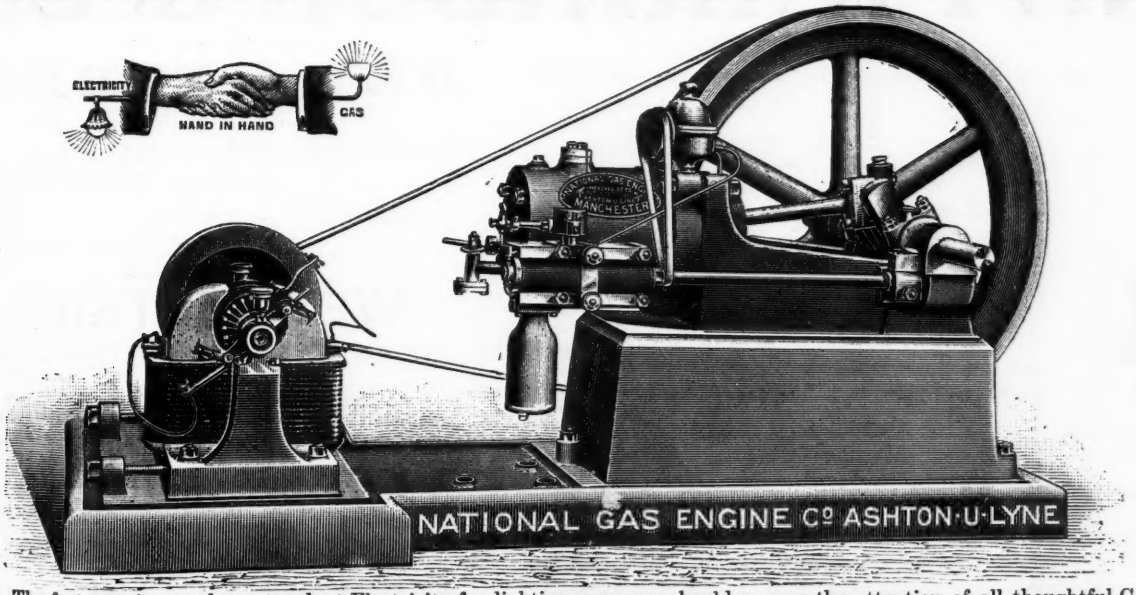
These Retort Lids and Fastenings are made in three forms, round, oval, and ∩ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

QUOTATIONS WILL BE GIVEN ON RECEIPT OF PARTICULARS OF REQUIREMENTS.

LIST OF PATTERNS ON APPLICATION.

Telegrams: "TANGYES, BIRMINGHAM." No. 90 E.

IMPORTANT TO GAS-WORKS MANAGERS



The fast growing tendency to adopt Electricity for lighting purposes should engage the attention of all thoughtful Gas-Works Managers and those interested in Gas Companies.

By the aid of the Gas-Engine driving the Dynamo, **50 PER CENT. MORE LIGHT CAN BE OBTAINED FROM THE SAME GAS;** and thus, by their adoption as the motive power, the gas consumption of the district can be maintained and the light increased.

The **NATIONAL GAS-ENGINE** is specially constructed for this purpose, both for Small Installations for isolated places, and also for large Central Electric Light Station Work.

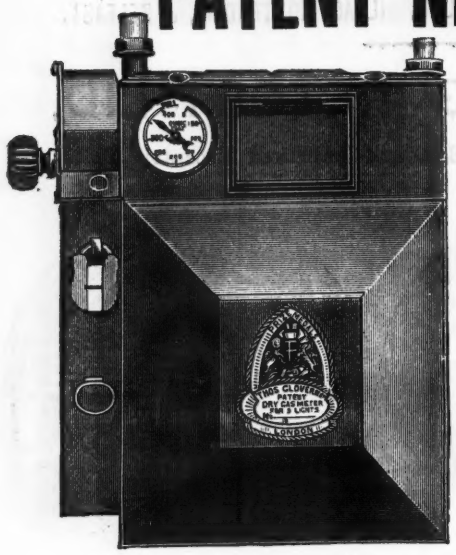
For Prices, Testimonials, and List of Users, apply to

THE NATIONAL GAS-ENGINE CO.,

ASHTON-UNDER-LYNE.

District Agents Wanted.

THOMAS GLOVER & CO.'S PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

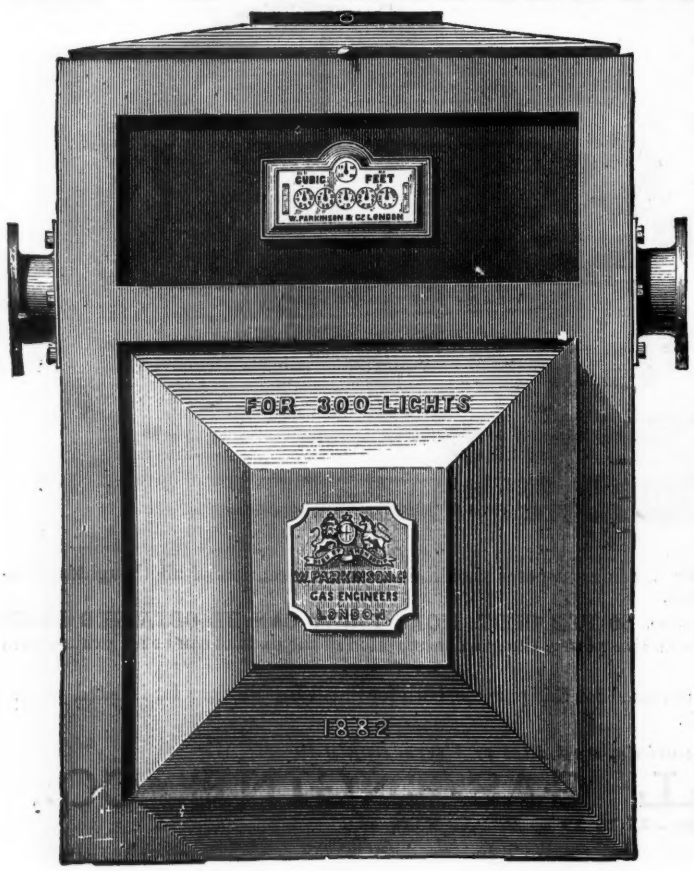
BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address: "GOTHIC."*

LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

W. PARKINSON & Co.



MANUFACTURERS OF

DRY METERS

OF THE VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

The CASES are of the Best CHARCOAL-TINNED PLATES.

WET METERS,

With PATENT THREE-PARTITION DRUMS.

STATION METERS AND GOVERNORS.

PRESSURE & EXHAUST REGISTERS,

MOTIVE POWER METERS,

Test Gasholders, Experimental Apparatus, &c.

PRESSURE-GAUGES OF EVERY DESCRIPTION.

NEW ILLUSTRATED CATALOGUE AND PRICE LIST
Sent post free on application.

COTTAGE LANE WORKS, CITY ROAD,

LONDON.

Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,

BIRMINGHAM.

Telegraphic Address: "GAS METERS."

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The South Metropolitan Bill Withdrawn 685
The Commercial Report and Accounts 686
The Dalmarnock Purifier Explosion 686
The Dubin Corporation and the Borough Funds Act 686
An Exposure of the Dockers' Union 687
The Collapse of the Trades Combinations 687

WATER AND SANITARY AFFAIRS—

The Position of the London Water Question 688
The Recent Board of Trade Inquiry at Aylesford 688
The Felixstowe and Walton Water Bill 688

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 689
Electric Lighting Memoranda 689
The Improvement of Lighting Duty 690
The Real and Alleged Defects of Flueless Gas-Stoves 691
The Legal Aspect of the Frost Question 692

NOTES:—

Blondel's "Lumen-Metre" 692
Water Supplies by Meter 692
Considerations of Luminous Efficiencies 692

TECHNICAL RECORD:—

Royal Society—The Action of Heat upon Ethylene. By Professor Vivian B. Lewes, F.I.C., F.C.S. (Second Paper) 693
The Composition of the Extinctive Atmospheres Produced by Flames. By Frank Clowes, D.Sc. 695
Mr. John West on Economical Lighting 696

REGISTER OF PATENTS:—

Gas and Other Internal Combustion Engines—Davy, D. . . . 698
Coin-Freed Gas-Meters—Thorp, T., Marsh, T. G., and Haynes, J. 698
Combined Gas-Lamp and Sewer-Gas Extractor and Destructor—Webb, J. E. 699
Water Gas Apparatus—Guldlin, O. N. 699
Patent Notices 699

CORRESPONDENCE:—

Threatened Litigation respecting the Oxy-Oil Gas Patents . . 700
Removing Carbon from Gas-Retorts 700
Shilling Prepayment Meters 700

PARLIAMENTARY INTELLIGENCE:—

House of Lords—Progress of Bills 700
House of Commons—South Metropolitan Gas Bill; Water Supply to Fire-Plugs; Progress of Bills 700
House of Commons Committee—South Metropolitan Gas Bill . . 701
The York Water Company's Bill 704

LEGAL INTELLIGENCE:—

High Court of Justice (Ireland)—Chancery Division—The Attorney-General (at the Relation of Adam S. Findlater) *v.* The Lord Mayor and Corporation of Dublin 705
High Court of Justice—Queen's Bench Division—Lear *v.* Shelley; The Quality of the Littlehampton Company's Gas 706
Birmingham County Court—Thompson *v.* The Corporation of Birmingham; Liability for Renewing an Improperly Laid Pipe 706
Embezzlement by a Collector of The Gaslight and Coke Company 707
A Curious Plea against the Payment of a Gas Account 707

MISCELLANEOUS:—

Edinburgh and Leith Gas Commission—Reports of the Engineers on Oil-Gas Processes 707
The Explosion at the Dalmarnock Gas-Works—Mr. Vernon Harcourt's Report to the Board of Trade 709
East London Water Company— Half-Yearly Report and Accounts 710
Proposed Purchase of the Norwich Water-Works by the Council . 710
Commercial Gas Company—The Half-Yearly Report and Accounts 711
Electric Lighting Notes 712
English and German Competition for Gas Coal Contracts . . . 712
Notes from Scotland 713
Current Sales of Gas Products 714
Coal Trade Reports 714
Gas and Water Companies' Stock and Share List 715

PARAGRAPHS:—

Mr. Arthur Ashton—Mr. W. Haffenden Winch—The Carlisle Appointment—Mr. Magnus Ohren, M.Inst.C.E. 687
Mr. Geoffrey Drage—Mr. Arthur Wharton—New Incandescent Gas Lighting Systems—Eastern Counties Gas Managers' Association 688
The Local Government Board and the London Water Companies—Another New Element 689
Professor Lewes at the Royal Society 692
The Prepayment Gas Meter Company, Limited—A Portable Incandescent Lamp—The Rarer Metals and their Alloys—Electric Lighting on Railways 693
A New Mantle for Incandescent Lighting—Securing Gaseous Occlusion in Coal 695
A New Sewer for Paris—Water Companies and the Recent Frost 698
Stockport and the Gas Supply of Heaton Norris—The Price and Quality of Gas at Ossett and Horbury 700
Stoking Machinery for the Tradeston Gas-Works, Glasgow . . 704
Explosion at the Saltley (Birmingham) Gas-Works—Tynemouth Gas Company 707
The Merthyr Tydfil Water Bill—The Recent Suffocation by Gas at North Kensington 710
Reduction in Price 712
Gas Exhibition at Derby—The Barnsley Water Bill—The Sale of Gas Residual Products in Glasgow—Dorking Gas Company—Sales of Stock and Shares—Torquay Gas Company 714
The Brentford Gas Company and Meter-Rents—Gas-Main Extensions in Glasgow—The Management of the Huntingdon and Godmanchester Gas-Works—Anniversary of the Gas Workers' Union 715

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Telegraphic Address: "GASKING LONDON."
Telephone Number: 2759.

EDITORIAL NOTES.

The South Metropolitan Bill Withdrawn.

THE Private Bill business of the present session of Parliament attained its culminating point of interest and importance last week, when the South Metropolitan Company's Bill, of which so much has been said, occupied the attention of the House of Commons and of Mr. Tatton Egerton's Committee—only to be withdrawn after all. The result is an all-round disappointment—not, however, without certain alleviations which are likely to have a notable influence upon the future proceedings of both the promoters and the opponents of this ill-fated measure. The Bill was wrecked by the division of the Board of Directors of the Company in regard to the policy of administration of the undertaking; by the circumstance of the President of the Board of Trade having given encouragement in the House to the idea of an inquiry into the whole system of Metropolitan Gas Supply; by the timidity of the Committee in face of the large issues raised before them; and, lastly, by the signal ability of Mr. Worsley Taylor, Q.C., who had the last word to say against it on behalf of the London County Council. The event seems like a striking justification of the foresight of Mr. George Livesey. In the course of the observations addressed by Mr. Livesey to his fellow-proprietors of the Company, on the occasion of the Wharncliffe meeting, and duly reported in the JOURNAL for Feb. 19, the Chairman explained that the idea of promoting the Bill was his, and that the scheme of it all was practically his also. Anybody could see that the proposed stock operations would be beneficial to the stockholders individually and collectively, and to the Company as a commercial concern. This being the case, it was certain to be opposed by the representatives of other interests; and, realizing that the burden of carrying the Bill through would fall upon him, Mr. Livesey thought that his much-canvassed suggestion for the improvement and consolidation of the relations between the Company and their workmen might be embodied in the measure, and would materially facilitate its passage through Parliament. All this, and the story of how the majority of the Board deemed it inadvisable to go on with the project, appears in print (see *ante*, p. 377). The majority of the Board have had their way; and the Bill is lost, after all the trouble and expense incurred in procuring the assents of the different classes of proprietors, and in the general work of promoting the measure.

It is open to anyone to argue that, if Mr. Livesey's advice had been followed in its entirety, the whole Bill would have gone through in safety. It is at least certain that the proposed clause for facilitating the appointment of workmen-directors has been received with general approval outside the South Metropolitan and Chartered Board-Rooms. It caught the fancy of the newspapers, with the exceptions of the ultra-Tory *Globe*, which has appeared to be better informed than is altogether befitting as to the inner counsels of the South Metropolitan Board, and the *Daily Chronicle*, which opposes the reconciliation of Capital and Labour, in the interest of Trade Unionism. Seeing that the clause had been dropped out of the Bill, Mr. Mundella took the unusual course of moving in the House on Wednesday an "Instruction" to the Committee to restore it, if deemed expedient; and he was supported by the actual President of the Board of Trade and Sir Michael Hicks-Beach, who has filled this office under a different Administration. Not a voice was raised against the proposal, which was carried unanimously; and it is known that the idea would have been influentially supported in the House of Lords. It was easy to make out a natural and close connection between the conversion of the Company's stock and the improvement of the Company's profit-sharing arrangements. But the idea was only advocated by Mr. Livesey in his individual capacity; and so the whole combination for the time being has fallen short of realization.

On the other hand, it is equally open to be argued that the reasons which led to the emasculation of the Bill, as the Chairman of the Committee put it, would have remained, and would have operated in the same way, if the workman-director clause had been included in it. Mr. Worsley Taylor said nothing to indicate that the County Council would have been placated by such an addition to the Bill; and it is difficult to see how the case he made out against

the stock-conversion project could be altered by any consideration with regard to the constitution of the Board of Directors. He did not succeed in carrying all his points; for he was instructed—for some inscrutable reason—to oppose the arrangements by which it was proposed to legalize the issue of stock to consumers and employees in preference to putting it up to auction. This was indeed the weakest part of a weighty and, on the whole, sensible speech. The proposed modification of the Standing Order which requires new stock issues to be publicly sold, is strictly in accordance with the spirit of the Standing Order, which is simply to ensure that the highest possible price shall be obtained for such issues. Experience shows that there is a way not only of getting the highest prices, but also of placing stock among a highly desirable order of purchasers; and it is sheer pedantry in the County Council to insist on the observance of the letter of a regulation clearly capable of being improved upon in some cases. Sir Courtenay Boyle, for the Board of Trade, endorsed the proposed arrangement; and the Committee would have sanctioned it, if the Company had chosen to accept this remnant of their request to the legislature. Of course, it was not worth while to do so. The contention that the proposed stock conversion would raise the value of the undertaking in the event of purchase by the local authority was absurd.

We are of opinion that the main considerations which influenced the Committee in their dealing with the Bill were fear lest the conversion scheme meant artificially increasing the capital value of the undertaking, and diffidence in disturbing (at the instance of a particular Company) a general settlement arrived at twenty years ago after an elaborate inquiry by a stronger Committee. Mr. Worsley Taylor "piled up" an awe-inspiring picture of the consequences that would ensue if the Bill passed; and, almost in so many words, he challenged the Committee to say if they thought themselves the men to grapple with the emergency. The event showed that they were not. It was a fair Committee of the ordinary description, and very attentive to the work laid upon it. The behaviour of members upon Private Bill Committees, and the quality of their work, have, in point of fact, greatly improved since the House of Commons took to keeping respectable hours. But Mr. Tatton Egerton and his colleagues are evidently not the men to tackle a legislative settlement referable to the late Mr. W. E. Forster. It is hardly to be wondered at. After all, the precedents of the Bristol and Oxford and Crystal Palace District Acts are not strong enough to guide an ordinary Select Committee in their dealings with the Gas Supply of the Metropolis; and we confess to a decided preference for Metropolitan Gas Legislation being ordered strictly upon the merits, after the fullest investigation and consideration by the most competent authority.

The matter will now rest for a season; and it is greatly to be hoped that in the interim conflicting opinions within the Company may be reconciled, and nothing more be either said or done outside to hinder so desirable a consummation. The dislike of Mr. Livesey's project expressed by the avowed organ of militant, tyrannous, and socialistic Trades Unionism, the *Daily Chronicle*, may be commended to the earnest attention of those who are inclined to fear it. This is one of the highest recommendations that the scheme has yet received. The newspaper in question says of it: "There may be circumstances under which such "a plan would have a good result. But a strong Trade "Union is, after all, the only efficient means by which "workmen can command a voice in the direction of "affairs; and without it a workman-director would be a "melancholy failure." What is happening at Leicester, and what has already happened at Hull, Manchester, in South London, and in many other places where Trades Unions have fancied themselves strong enough to "command a voice in the direction of affairs," is a sufficiently pointed commentary upon this observation.

The Commercial Report and Accounts.

In another column will be found the Directors' report and the principal portions of the statement of accounts relating to the last half-year's working of the Commercial Gas Company, which will be presented to the proprietors at the ordinary general meeting to be held next Thursday. The report states that the revenue account shows a net profit for the half year of £49,466; and with the addition of interest and the amount brought forward from the previous account, less interest on debenture stock, there is £71,093 available for division. The Directors recommend dividends of 13½ per cent. on the old, and 10½ per cent. on the new stock; leaving an undivided balance equal to ¼ per cent., which it is proposed to carry to the reserve fund. For the corresponding period of 1893, the revenue account shows a profit balance of £59,132, with gas at 2d. per 1000 cubic feet dearer. There has been a decrease, on this account, of £2404 in gas revenue, while residuals have also dropped from £53,018 to £46,213, which is wholly due to the diminished value of coke and sulphate of ammonia. The quantity of gas sold shows an increase of 4·1 per cent., which for the Commercial district must be regarded as very satisfactory. Coals cost £871 more; and the other manufacturing charges are proportionately higher. Distribution came to slightly less. The other entries in the revenue account do not call for comment. Altogether, it cost £133,755 to do the increased amount of business, as compared with £132,881, which shows how closely all these expenses are watched. There will not be a very great deal for the Chairman—Mr. J. Blacket Gill—to explain to the meeting on Thursday. The fixing of prepayment meters in the Company's district is progressing, albeit not so rapidly, to judge from the figures relating to this class of business, as might have been expected. In view of the high dividends now earned by the Company, it would be interesting to learn if the Board have any ideas on the subject of stock conversion.

The Dalmarnock Purifier Explosion.

We give in another part of our pages the essential portion of Mr. A. G. Vernon Harcourt's report to the Board of Trade on the accident to the purifier at the Dalmarnock Gas-Works of the Glasgow Corporation, as to which he held a local inquiry in February, as noticed in the Journal at the time. Mr. Harcourt's statement is very clear and interesting. He finds that the explosion happened while a purifier was being emptied of foul lime in the ordinary way. It was only the gaseous mixture that remained "as usual" beneath the layer of lime that took fire—the valves being perfectly closed; and Mr. Harcourt thinks that no blame attaches to the Manager of the works, or to his foreman, for allowing the men to work with this explosive mixture of gas and air beneath their feet. Upon the question of how the mixture was ignited, Mr. Harcourt agrees with the opinion expressed at the inquiry by Mr. Foulis and others—that it was fired by a spark struck by a labourer's shovel. There was plenty of evidence to show that sparks can be, and are, struck by shovels used in shifting lime in purifiers; so that it is a perfectly fair inference that a spark could have been struck on the occasion in question. But then comes the further point whether such sparks will ignite coal gas, or a mixture of coal gas and air. In the ordinary way, they will not do this, as Mr. Harcourt observes; but he established by experiment the interesting fact that the result can be brought about by the addition to the gaseous mixture of a small proportion of the vapour of bisulphide of carbon, or of sulphuretted hydrogen. So he concludes that "the "cause of the ignition of the gas suggested by Mr. Foulis "and others is a possible cause, and was the actual cause, "though the concurrence of the conditions under which "gas can be thus ignited is so rare that none of the "witnesses knew of such a thing having happened before." It only remains to discuss means whereby the coincidence of hazardous conditions specified by Mr. Harcourt may be prevented, both in the Glasgow works and wherever else the same systems of gas purification and purifier working are followed; and we cannot do better than refer readers to the report itself for enlightenment upon this head. It is satisfactory to have it certified by so careful and conscientious an investigator, that the explosion at the Dalmarnock station was a pure accident, and as such was "not due to any act or default or negli-"gence of the managers of the works, or of any person in "their employment." This is a perfect clearing up of a curious occurrence, and augurs well for the utility of the Notice of Accidents Act, under which the inquiry—the first of the kind—was held.

The Dublin Corporation and the Borough Funds Act.

Mention has been made in this column of the extraordinary proposal of the Corporation of Dublin to take a second poll of the ratepayers in regard to their proposed

Improvement Bill; and it is desirable, by way of closing the topic, to record here that the Irish Master of the Rolls has granted an injunction restraining the Corporation from taking any further steps in the matter. The gist of the observations of the Master of the Rolls upon the subject was given in our last week's issue. These remarks were somewhat diffuse, and went off upon several points not included in the application to the Court. But his Lordship was commendably clear and strong as to there being nothing in the Borough Funds Act to enable any second meeting or poll to be held within the same session of Parliament. This is all that it was necessary to lay down in order to put a stop to the vagaries of the Dublin Corporation. This authority probably considers itself a "popular" body, like the London County Council; and it is evidently a cardinal point of "popular" municipal politics to disregard the "voice of the people" whenever it does not harmonize with the wishes of the authority. We also referred last week, in an article dealing with various measures now before Parliament, to the Bill which Sir Albert Rollit and others are promoting for the amendment of the Borough Funds Act, by relieving the local authority of the necessity for taking a poll of the ratepayers upon a Bill unless one-tenth of the number of municipal electors require it. There is no difficulty in seeing through this project, which would have the effect of rendering polls practically obsolete. But if there were any doubt on this head, it would be dispelled by the circumstance that Sir Albert Rollit's Bill is warmly supported by the Lord Mayor of Dublin. Happily for the ratepayers of the United Kingdom, this most mischievous measure has been blocked, and probably will not pass. It may be, as the Lord Mayor claims, that the Borough Funds Act places difficulties in the way of Corporations desirous of promoting Bills to which perhaps only five ratepayers take strong objection; but it does not follow that these difficulties often work to the detriment of localities. Judging from the crop of Municipal Bills that occupy the attention of Parliament one year after another, it does not appear that local authorities are much hindered from indulging in as many legislative projects as are good for them. In the case in point, Dublin certainly has reason to be thankful that the common sense of a few of the citizens has saved the municipal treasury from a heavy drain upon it in the interests apparently of a mere handful of lawyers and politicians. The rates of cities like Dublin go to pay many more *de facto* officials than are borne upon the list of salaried officers.

An Exposure of the Dockers' Union.

To do to others as one would be done by, is an old-fashioned rule of conduct to which one can hardly expect the lights of modern Socialistic Progressivism to conform. Still less do these gentry see the justice of being done by as they did. Our prize demagogues are great at vilification; and the things they permit themselves to say of those opposed to them, when engaged in the congenial and not unprofitable task of leading a strike, are usually an illustration of what the poet meant by describing language as "frequent, "and painful, and free." But if you tell one of these exalted personages that he is not so popular with his supporters as he was, and hint that he is hardly worth what he costs them, he will hale you before a jury of his countrymen, and demand heavy damages for the aspersion upon his character. This is what Mr. Alderman Ben Tillett did last week to a newspaper which ventured to comment upon his relations to the members of the Dockers' Union; and now he is probably sorry for having done so, on more than one score. For not only did he fail in his action, but the other side managed to drag to light such admissions respecting the purpose for which the Dockers' Union really exists, that it is highly probable that Mr. Tillett may speedily find himself in the same box with the equally notorious Mr. J. Havelock Wilson, as a leader without a following, and the only monument of a Union which has been reduced to an unsavoury memory. How completely the Dockers' strike and Union "made" Mr. Alderman Tillett, came out clearly from his own evidence; and it was rendered equally clear that the Union, which began to go to pieces over the Hull strike, only continues its invalid existence for the benefit of himself and the other paid officials. Mr. Tillett's salary is only £160 a year; but when he is "on tour" for the Union, he gets in addition his travelling expenses, as he told the Court, and an allowance of 10s. a day for "incidentals," and he is paid for lectures anything from 5s. to £2 a time. He and the other officials graciously take between £4000 and £5000 a year for managing the Union, which is, or has been, supported by the more or less voluntary subscription of 3d. per week, taken from men whom he himself has often described as sunk in grinding poverty. Do the Dockers get value for their money? Let Hull answer the question. Naturally, Mr. Tillett receives the tearful condolences of the *Daily Chronicle* upon his unfortunate experiences of the law; but the commiseration of the whole Progressive party of the London County Council will not avail to pay his costs, since they will not be in a hurry to feel for him in the only part he would appreciate —their own pockets. It is a boon to the community when these hangers-on of industrial communities are exposed in their true characters. The New Union movement is being quelled, not so much by the actions of its opponents, as by the mismanagement of its wire-pullers and fuglemen.

The Collapse of the Trades Combinations.

It is currently reported, with what amount of truth we are unable to say, that one by one the various traders' "rings" that have afflicted the gas industry for some time are breaking up under the pressure of the usual disintegrating forces. We do not mean that all the combinations for the regulation of the prices of gas-works necessaries of which our readers have cognizance are actually or even prospectively falling through. There are some mutual organizations of this nature which are not at all objectionable, either in motive or in operation, inasmuch as they merely standardize the prices of some articles of manufacture at limits which enable the makers to realize a living profit, and are kept in check by the circumstance that the largest buyers have it in their power to manufacture for themselves if prices should be unduly raised against them. Cut-throat competition is to be deprecated in the interest of good work and fair dealing. The "rings" we refer to as being in a bad way are those against which influential correspondents of the Journal have protested, as having for their object the forcing up of prices beyond all reasonable figures. We learn that the inevitable has happened, and that internal dissensions and scarcity of orders have proved in several trades a combination stronger than the artificial tie by which it was thought to bind the trade to a protective policy. As we report elsewhere, the Durham coal men have lost most of the Rotterdam contract to the Germans; and they are told by local public opinion that they had better abandon their attempts to keep up prices against the world, and set themselves rather to retain their old markets, find new ones, and do their best to reduce the cost of production. We have heard lately of several offers of coal to southern buyers at prices which a short time ago would have been scouted. It looks as if the advantage, such as it was, that association procured for the traders has already proved a temporary benefit, and that it will have to be paid for by a heavy sacrifice in the near future. We shall be sorry for the sufferers, if this is to be the way of it; but there is rarely any escape from the consequences for those who set themselves to defy economic laws.

Mr. Arthur Ashton, who for a number of years has been Chairman of the Huntingdon and Godmanchester Gas Company, has resigned that position.

Mr. W. Haffenden Winch, of Cranbrook, one of the founders and a Director of the Cranbrook Gas Company, died suddenly last Wednesday evening, in his 75th year.

The Carlisle Appointment.—The Gas and Water Committee of the Carlisle Corporation have decided to recommend Mr. C. B. Newton, Assoc.M.Inst. C.E., of Rotherham, as the successor to Mr. Joseph Hepworth as Gas and Water Engineer of the Corporation. There were, it may be remembered, 33 candidates for the appointment, and five were selected for further inquiry. This number was afterwards reduced to three; and eventually the Committee chose Mr. Newton.

Mr. Magnus Ohren, M.Inst.C.E.—A large number of our readers will, we are sure, join us in offering hearty congratulations to Mr. and Mrs. Magnus Ohren, who on Sunday next will celebrate their golden wedding, having been married on the 7th of April, 1845. It will also doubtless be a pleasure to learn that, though failing health compelled Mr. Ohren to retire from the secretaryship of the Crystal Palace District Gas Company, after 38 years' service, the rest he has since been able to take has helped to restore much of his former strength.

WATER AND SANITARY AFFAIRS.

THE President of the Local Government Board, at a meeting of the London Reform Union, held last week, made a declaration which has all the pretensions of a "program," however unlikely of accomplishment. "Look-"ing to the immediate future," Mr. Shaw Lefevre said the three great questions affecting the Metropolis were the taxation of ground-rents, the purchase of the Water Companies, and the unification of London. The first of these projects was described as "becoming ripe for legis-"lation." The purchase of the Water Companies was simply covered by the phrase "the immediate future," which we suppose may mean any date after Easter, though as to the "immediate" character of the epoch there is room for doubt. For unification, a Bill is to be introduced "at the proper time;" and the preparation of the measure has engaged the personal attention of Mr. Shaw Lefevre for the last six weeks. The first step towards the purchase of the London Water Companies consists in the coming inquiry before a Hybrid Committee of the House of Commons, to which the Lambeth Transfer Bill of the London County Council has been referred, together with a corresponding measure relative to the Southwark and Vauxhall Company. Against the first of these Bills more than forty petitions have been deposited, emanating from a variety of authorities, including the Corporations of London, West Ham, Kingston-upon-Thames, and Croydon, the Conservators of the Thames, the Vestries of Marylebone and St. George's, Hanover Square, the Wandsworth District Board of Works, and the Councils of the Home Counties, together with a number of Councils representing urban and rural districts. Granting that some of the petitions may merely be of a precautionary character, it is evident, on the whole, that the County Council scheme is viewed with a large amount of disapprobation, or at best with suspicion. The eight London Water Companies, in petitioning against the Bills, have thus cause for encouragement in finding a cloud of allies gathering round them, though on the Companies will fall the real brunt of the fight. So far as public opinion is concerned, especially as shown by the County Council election, there are unquestionable tokens of an increasing apprehension that the policy which has given rise to the Transfer Bills has not been conceived in the interests of the ratepayers or the consumers. The presence of an increased number of Moderates on the Council does not alter the character of the Bills; their origin being found in a past state of things. But the position of the Council is very materially affected—that is to say, shaken—by recent events; and Mr. Shaw Lefevre is constrained to acknowledge that he has been "greatly disappointed and surprised" by the result of the late County Council election. Perhaps some further experience of a similar nature, respecting the projects espoused by the Progressives, awaits the President of the Local Government Board. The Parliamentary Committee of the County Council state, in a report which is to be presented to-day, that they have prepared a Bill to authorize the Council to raise and expend money on capital account in connection with the acquisition of the water-works from the London Water Companies. It will be necessary to introduce the Bill as a public measure; "but it will not be proceeded with in the event of the "Transfer Bills not passing this session."

There is a homely and familiar saying about the folly of anyone who "bites off his nose to spite his face;" but, at Aylesford, in Kent, there seem to be a good many misguided persons who owe themselves some such grudge, though it takes the form of a delusion that they owe the grudge to the Mid-Kent Water Company. The Company require to raise new capital for the purpose of constructing additional works, but find themselves confronted with the determined opposition of several of the Local Authorities. The question appears, indeed, to have been in abeyance since 1889, when the Company applied for a Provisional Order, which was refused. Since then local water consumers (or a section of them) have vigorously maintained a spirit inimical to their own interests. These wise men of Aylesford and Eccles were firmly convinced that they could procure for themselves a better water supply than the Company could place at their disposal. But though five long years are past and gone, nothing practical has been done by those who consider themselves men of light and leading in the locality towards providing this independent supply. Eccles still has to get its water from wells not more than 16 to 20 feet deep—wells, moreover, which, from the nature of the soil, and the propinquity of cesspools, are almost inevitably polluted by sewage. Yet, will it be believed? though the Company are still prepared to guarantee an ample water supply for the district at a charge of 2d. per head per week, the renewed application for the necessary Provisional Order has again this year encountered the strongest opposition. The financial folly and the suicidal "sanitation" of this attitude were conclusively shown at the recent Board of Trade inquiry, when the Company's Engineer explained that the cost of the artesian well which the Eccles Local Authority are now advocating—being bound to advocate something or else make way—would be about £5000, exclusive of law costs in connection with proceedings to which any attempt to sink the well in the proposed position would certainly give rise. Such a sum, if borrowed at 4½ per cent., for 30 years, would cost the parish £225 per annum; while the Company are actually prepared to supply water to three adjoining parishes for an aggregate sum of £140 to £150 a year (which in certain events might be considerably diminished). It is true that an Engineer called on behalf of the opponents of the Order thought that the well need not cost more than £2000, exclusive of various items, which, however, could not prudently be excluded from the calculations. Finally, indeed, the utter weakness of the position in which the opponents of the Company found themselves seems to have dawned upon the leading spirits of the opposition; and it was intimated that, on the terms offered, the Eccles people might "consider the matter in a favourable light." Better late than never! We do not, of course, venture to predict the outcome of the Inspector's pending report to the Board of Trade, and have merely noticed the case as a glaring example of that spirit of perversity and self-injury which seems to lay hold of ratepayers of a certain type when it is whispered about that a Water Company, or any other Company, are making (or going to make) "a good thing" out of a local undertaking.

By way of postscript to certain remarks which have recently been made in the JOURNAL on the subject of the compulsory purchase of water-works, we may call attention to what has taken place in the Lords' Committee on the Felixstowe and Walton Water Bill. The formidable (or apparently formidable) opposition to the preamble of the Bill has melted away; Mr. Bidder having announced to the Committee that his clients, the District Council, were quite prepared to accept a clause empowering the Local Authority to purchase the undertaking, upon giving notice to the Company, on such terms as should be settled by arbitration under the Lands Clauses Act. This, of course, means following the precedent just previously recognized and enforced by the Committee on the Ambleside Bill, to which reference was made in the JOURNAL last week. Henceforth, we ought to hear no more of such clauses as those which the London County Council originated, and lesser Councils have sought to imitate. The new device for "robbery under arms" has virtually been nipped in the bud, so far at least as the Lords have power to nip it. Timid holders of water shares, may therefore for a space—if not for all time—breathe freely.

Mr. Geoffrey Drage has resigned his position as Secretary to the Liberty and Property Defence League.

Mr. Arthur Wharton, of Nottingham, has been appointed Manager of the Plymouth Gas-Works, in succession to Mr. H. Townsend, whose resignation of the position was announced in the JOURNAL a short time ago.

New Incandescent Gas Lighting Systems.—We learn that a Company has just been formed in Dresden, to be known as the Gesellschaft für Glühlicht-beleuchtung, to acquire and exploit the incandescent lighting patents of Herr Otto Steuer, of Dresden. A Company has also just been formed in Berlin, to be known as the Gesellschaft Gasglühlicht Gautzsch, to acquire and exploit the Gautzsch incandescent lighting patents.

Eastern Counties Gas Managers' Association.—Owing to the continued illness of the President of this Association (Mr. C. W. Grimwood, of Sudbury) from an internal complaint, as well as of Mr. Harry Wimhurst, the Honorary Secretary, from influenza, followed by congestion of the lungs, the Committee have decided to postpone the spring meeting at Sudbury to Thursday, the 16th of May. In making this announcement, we are asked to state that the Secretary will be glad if members having any objection to the change will communicate with him.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 715.)

THE Stock Exchange week just closed was at first quiet and uneventful; but prices in general kept their position very well. Later on, however, an awakening incident unexpectedly occurred in the Niger announcement. Prices began to drop in anticipation of something like a scare. But it did not come off to any extent; and the close was enlivened by the armistice in the East. So that, on the balance, prices for the most show an improvement. The enormous business doing in mines culminated in the breakdown of the Clearing House. This incident, coupled with the Throgmorton Street block, seems to indicate that the Exchange facilities want expansion in more ways than one. Money was in good demand; but requirements this month are not likely to amount to much. Business in Gas showed no disposition to improve in activity at first; but in the middle of the week, it grew more brisk, and then relapsed again. The general tendency was just as firm as ever. In Gaslights, the "A" immediately showed a wish to rise; and on Thursday a bargain was done specially at 270—the best of the week—and the closing deal was only a fraction lower. The secured issues were quite left alone, except the 4 per cent. debenture, which was in demand, and advanced a point. In South Metropolitans, there was considerable uncertainty how to make the price when it was known that the House of Commons Committee refused to sanction the stock-splitting clause in the Company's Bill; and the quotation was left very open. The issue of the Commercial report and accounts completes the Metropolitan record for the last half year, and shows the satisfactory position of the Company. Business in their stocks is still almost stagnant. The Suburban and Provincial Companies continue to advance; Bristol this time showing the way with a large gain. The Continentals were quieter; but prices are creeping up higher. There was nothing very noticeable among the rest. Not much stock of the Water Companies changed hands; but the quotations of most of them were put down a point or two. Southwark "D," which had inadvertently been left in the previous week at a higher figure than the ordinary, was set back into line.

The daily operations were: Very quiet business in Gas on Monday; and the only move was a rise of 1½ in Bristol. In Water, East London and Southwark ordinary fell 1 each. Tuesday was equally quiet; and Bristol rose 1 more. Southwark "D" receded 12. Gas was more active on Wednesday. Gaslight "A" and Imperial Continental rose 2 each; and Alliance, ½. In Water, Kent fell 2½; and West Middlesex, 1. On Thursday, only Gaslight "A" showed any activity. Bristol advanced 1; and European, ½. On Friday, transactions in Gas were very restricted. South Metropolitan "A" fell 5; ditto "B," 5½; and ditto "C," 7. In Water, Lambeth dropped 1. On Saturday, there was a sharp reaction in South Metropolitans; and the "B" recovered 5. Gaslight 4 per cent. debenture improved 1. Water was unchanged.

ELECTRIC LIGHTING MEMORANDA.

Major Cardew on the Southwark Bridge Explosions—Important Pronouncement of the United States Supreme Court on the Duration of United States Patents.

MAJOR CARDEW has reported upon the circumstances connected with the explosions which occurred on and about Southwark Bridge on Feb. 1 last. After describing the respective positions of the gas-mains and the electric-light culverts, the Inspector remarks that the most striking features of this affair are the distance to which it appears that a series of explosions may travel along the electric mains which now form a gigantic network under the whole of the streets of the City of London; and the proof it affords of the insufficiency of any ordinary system of pipe and street-box ventilation, if gas is able to get into them easily. In this case, the culvert which exploded was provided with large openings in the shape of catch-pits and gulley gratings, by means of which gas might have escaped; and yet these did not prevent the explosion. The singular thing is that, while the gas which was in the culvert did not make its way out of these holes, the light which exploded it probably reached the interior by this means. Yet, after all, the circumstance is not mysterious; for the leak of gas which found its way into the culvert was continuous, so that as fast as the culvert emptied itself of the gaseous mixture, it was refilled from the same source. Major Cardew thinks, after duly pondering the matter, that if his previous recommendations as to the prevention of explosions in street conduits (already mentioned in these columns) had been carried out in this case, there would not have been any explosion. So far, the Electric Lighting Company have done little towards carrying out these requirements. Major Cardew refers to the defect in the gas-main which was the principal cause of the explosions on the bridge; and he lays stress upon "the very serious danger to the public arising from the condition of the gas-pipes in many districts, and the way in which they are laid and supported." He hastens to say, however, that "no remissness on the part of the Gas Companies can relieve the Electric Lighting Company of the duty of thoroughly complying with the regulations." So far as the condition of the gas-pipe in this instance is concerned, we were under the impression that it was proved to have failed in consequence of having been deprived of support by the workmen of the highway authority. It will be a bad look-out for gas companies if the consequences of every interference with their mains are laid to their charge.

The electric lighting interest of the United States has been greatly excited over the issue of a patent suit brought by plaintiffs calling themselves the Bate Refrigerating Company, against an alleged infringer of their rights. It does not appear, at first glance, what is the connection between a refrigerating company's patent, presumably for a refrigerator, and electric lighting; for although heating and cooking by electricity have attained some sort of success in this country, this agency has nowhere, so far as we are informed, been applied to cooling purposes, except in the indirect way of creating a "frost" for investors. The interest of the Bate refrigerator lawsuit and its issue, however, is not technical, but legal, and refers to the question of the duration of a United States patent. Not long ago the patent law of the States was revised; and it was enacted that native patents should not remain in force longer than the shortest foreign patent previously granted for the same invention. This seems plain enough. But in law, things are not always what they seem; and various efforts have been made by American patentees to procure authoritative interpretation of the statute capable of being "understanded of the people." The principal question has been as to whether the limitation of the life of a United States patent in the manner specified should not be confined to cases of foreign patents granted prior to the filing of the application for the American patent. The difficulty appears to have arisen out of the dilatory procedure of the United States Patent Office, which may, and often does, permit months and years to elapse between the receipt of the application and the issue of the patent. In the case in point, an inventor applied for a United States patent on Dec. 7, 1876, and did not get it till the following November. In the interval, he took out a Canadian patent for five years, and a British patent, for fourteen years. The Supreme Court now decides that, inasmuch as these patents antedated the belated United States patent, the latter expires simultaneously with the briefer of them. This decision does more than restrict the duration of the Bate refrigerator patent. It also throws open the incandescent electric lamp industry, the telephone industry, and several others. Some of the telephone patents were only issued in 1892, although they were applied for fourteen or fifteen years previously. The idea in this procedure was to keep them back until the original Bell patent had nearly expired, when it was intended to bring them forward for the purpose of prolonging the monopoly until 1908. Now these carefully-nursed patents are null and void; and the public of the United States will have a better chance of seeing the fruits of science and industry in the electrical industries developed for their advantage. The collapse of the monopolists is complete; and after what was said in this column last week of the evils of the system of exploiting American fundamental patents according to the American manner, the result is one upon which the people of the United States are to be congratulated. The American patent arrangements are bad enough; but they have been so worked by interested persons as to oppress the public with a load grievous indeed. Now there seems to be a prospect of improvement in this regard; and there is in the States such a strong feeling against patent monopolists, that there is little prospect of the decision of the Supreme Court being passed over by another alteration of the law. Meanwhile, it is a remarkable illustration of the patient way in which the American public take accomplished facts, that the monopolists themselves and their newspaper backers do not so much as utter complaint under a pronouncement that deprives them of their power and perquisites.

The Local Government Board and the London Water Companies.—In our article on "Water and Sanitary Affairs" last week, reference was made to a memorial which the inhabitants of Greenwich and the district were preparing for presentation to the Local Government Board, praying for an investigation into the condition of the Kent Water Company's mains during the recent severe weather. The memorial has been presented; and the President (Right Hon. G. Shaw Lefevre) has informed the parties that the subject shall receive every attention from the Board.

Another New Element.—At the annual meeting of the Chemical Society last Wednesday, the discovery of a new element was announced by Professor Ramsay. He said that, in his endeavours to discover whether argon combined with any other element, he made some experiments with a rare earth that was stated to yield nitrogen on being attacked by sulphuric acid. As he had anticipated, argon was given off, and not nitrogen; but mixed with it he found what appeared to be another gas. This gas is no other than the hypothetical helium, whose existence has only been inferred up to the present from a line D_3 in the solar spectrum. There is no doubt about the discovery, which was confirmed by Professor Crookes, who gave the wave-length of the line—587·47.

THE IMPROVEMENT OF LIGHTING DUTY.

A HIGHLY suggestive article was published a short time since in the *Electrician*, in which what was described as an "outstanding problem" of the engineering of lighting—the direct production of light-waves—was stated and discussed in an interesting and instructive manner. Briefly put, the problem in question is the one which is popularly, but erroneously, stated as the production of light without heat. More exactly, the problem is stated to be that of "exciting definite single waves of radiation, simple waves of one given wave-length." The popular error that a solution of such a problem would mean the production of light without heat is exposed by the consideration that, inasmuch as a given quantity of luminous radiant energy will produce just as much heat as, and no more than, an equal quantity of non-luminous radiation, what is really needed is to be able to produce light without unnecessary heat. In short, the requirements of this line of research after the light of the future is, as our contemporary put it, "to be able to transform any amount of non-radiant energy into an equal amount of non-radiant energy, of an absolutely controlled character as regards wave-length." The requirement is so definite that there is strong *primâ facie* improbability against its ever being fulfilled—at any rate, in the way in which we are able to conceive of its being satisfied.

There is a vast bulk of experience which goes to show that the admitted *desiderata* of the arts and sciences, as these are perceived by contemporary observers, and obligingly specified for the guidance of aspiring inventors, are very rarely supplied by direct effort. Any technical writer can supply off-hand a long list of the methods and results for which his own speciality has been waiting for years, and still waits, notwithstanding the certainty that whoever could satisfy the least of them would be a made man. It may, indeed, be generally laid down that, as soon as a want has existed in science or technics long enough to make itself generally felt, it is likely to remain so; and humanity is only likely to escape from it, if at all, by some indirect means of procuring satisfaction. Speaking metaphorically, an admitted want in science and technology is a fortress elevated in the sight of the industrial army, for anybody who can to take, but which is usually passed by with a tacit acknowledgment of its impregnability. And what men know themselves unable to take possession of, they end by leaving alone and doing without.

The same order of reflection occurs to a thoughtful observer of the various "guesses into futurity" with which certain writers of books and magazine articles amuse the uncritical public of persons who feel an occasional pulse of languid interest in the question of what their distant descendants will do for light, warmth, food, and other necessaries of life, when we who satisfy our own needs in these respects by the familiar methods are gone, with the materials of our satisfaction. There is never, nor can there ever be, the smallest helpfulness in contemporary forecasts of what the appliances of civilization will be like in a future distant enough to bring new conditions into civilized life. What can be predicted, if any reason can be given for the forecast, might conceivably be realized in the present. Man can no more jump out of his own skin or away from his own shadow, than he can tell how his remote descendants will face the new conditions that may, and almost certainly will, be laid upon them, with the light his present knowledge of the world and its needs and satisfactions affords him.

To return, however, to the "outstanding problem" of lighting. It is pointed out that the difficulty of exciting an harmonic variation in any medium in which energy is manifested is not peculiar to the medium which transmits light, nor to those particular wave-lengths which are supposed to be originated by heated or luminous bodies. On the contrary, it presents itself in connection with everything that can be classified as a propagation of energy by the harmonic variations of any medium. Thus it is admittedly difficult, to the verge of impossibility, to produce a pure and simple tone in music. Sonorous harmonics, overtones, and undertones—audible, and doubtless supra-audible and infra-audible—are inseparable from the operation of every appliance designed to produce a simple wave of sound. Even in mechanism of the grosser kind, as in the steam or the gas engine, a simple harmonic motion is often difficult or impossible to obtain. In short, wherever and whenever it is sought to produce a simple harmonic variation in a medium for transmitting energy, the desired result is only attained at the cost of more or less waste in eddies, and incidental losses which are the consequences of lack of perfect control over the nature of the harmonic wave.

If this observation applies to the working of apparatus of the same order of magnitude as man himself, and where the design and the working of it are more or less subject to his will, how much more does it weigh upon such phenomena as those of luminous radiant energy, where the apparatus is of atomic magnitude with the design completely, and the mode of working almost completely, beyond the power of man to control. Whether the source of the radiation is a solid, a liquid, or a gas, it is an engine which man did not make; and he can only attribute the resultant phenomena to the existence of something capable of transmitting radiations—the ether—about which he knows absolutely nothing. Moreover, every such engine has its own proper ways of working, and until we learn something of these, we cannot induce it to work at all; for it will work in no other ways, and it has no regard whatever for our wishes in the matter.

The problem of producing selected radiations would appear to have the greatest difficulty in relation to solids and gases, and the least in relation to gases. The former are of a more complex structure, with more irregular atomic and molecular motions than those of gas; while in the latter the particular wave-lengths which arise when radiant energy is emitted are comparatively few in number. Yet far more luminous radiation is obtained from heated solids than from heated gas or vapour, which hardly glows at all. It is argued, however, that heating is anything but an ideal method of exciting luminous radiation; and it would appear from modern researches that when a different excitant is employed, gases are nearly, if not quite, as good respondents as anything else. "It is in the fewness of molecules and the simplicity of molecular structure that the hope of solving the problem mainly appears to lie."

It is open to remark that all this is general, and that what is really wanted is not so much control over every wave-length of radiated energy, as power to affect the wave-lengths within certain limits—namely, the limits of visibility in the spectrum. The former, however, includes the latter; because, in order to be quite sure of being able to transform all of an available supply of energy into light, it would be necessary to first have complete control over the character of the waves produced, which would be impossible without complete control over all its components. "The engineer ought to be able to draw up a balance-sheet, perfectly accounting for every foot-pound of the radiation, just as he can produce a balance-sheet to account for the heat developed in a boiler furnace." Of course, this is an ideal; but it is only when we recognize an ideal standard of perfection in anything that we are sure of being able to improve the real.

Two practical openings are at the present time being made through the rocky obstacles that separate the real from the ideal in the production of artificial light. One is being worked by Tesla and others, and aims at the excitation of definite radiation by direct electrical means; the other is concerned with the production of higher radiant duty from heated substances by selecting those which possess a high coefficient of emissivity for the heat applied to them. Of such is the Welsbach system of gas lighting. But the prospects of the method are no monopoly of any single inventor. Attention is drawn to the noted fact that lime and other earthy oxides, as used in the lime light, possess the property of emitting at first an abnormally high radiation, which, however, quickly falls off, and assumes a normal proportion. Messrs. Nichols and Crehore remark, upon some experiments with lime and the oxy-hydrogen flame, that in ten minutes from the moment of ignition the light fell from about 10 to about 3 per cent. of the total radiation; and at the end of the first half hour it had fallen to the steady value of about 2 per cent. Subsequent cooling and exposure to the air enabled the lime to recover this power of abnormal emissivity; the degree of recuperation varying in different samples of lime cylinders—why? And what is the secret of the action of the components of the Welsbach mantle-dressing solution?

There is something here which it will probably pay well to find out. Apart altogether from the physical state of the radiant substance, some materials give a higher radiant duty for the same amount of excitation than others; and not a glimmer of knowledge as to why this is so has yet been grasped by man. Meanwhile, we venture to suggest that to talk too much about wave-lengths and other attributes of the ether in connection with this problem may well be a darkening of counsel. We know too little about this hypothetical form or state of matter, which has its sole reason for presumed existence in the incapacity of the human mind for grasping the idea of "action at a distance," to make the improvement of lighting hang upon anything that the text-books can tell us on this head. Indeed, a correspondent of the *Engineer* wrote only a few days ago to remark that the usually accepted theory of the luminiferous ether is incompatible with the phenomena presented by the Benham spinning-top. The theory says that white light is composed of waves of different lengths, which when spread out in the spectrum are seen to have different colours. Mr. Benham provides a disc-top with a black and white card—the black and white being arranged on a definite scheme; and when the top is spun with sufficient rapidity, the optical effect produced is not grey, but a coloured disc. This is not the only paradox to which the theory of the luminiferous ether has given rise; but it is one of the latest. And though it may be explicable in full agreement with the undulating theory, it seems pretty clear that a theory which affords room for such a surprise cannot be of much service as a guide to searchers into the secrets of Nature. In fact, one of the most curious features of the current theory of the ether is the readiness with which it is made to allow for any inconsistency which may crop up to disturb preconceived ideas of its nature. It is presumed to be a something; but beyond the one positive attribute of a power of transmitting radiant energy, all that can be predicated respecting it is negative. If the astronomer says that it cannot possess substance, or the tails of comets would suffer, the objection is allowed; and so is every other that proves the lack of a particular quality such as we have learnt to connect with matter. What engineers have to do with regard to the problem of the

improvement of lighting media is to work away at the clues to possibilities of obtaining higher duties which are already in their hands, and leave the wave-lengths and points of theory to be adjusted to facts as they are established. This can be readily done; and, in any case, it will be easier to frame any number of hypotheses about the operation of a new artificial light than to make the light itself.

THE REAL AND ALLEGED DEFECTS OF FLUELESS GAS-STOVES.

The question of the real and alleged defects of flueless gas-stoves has been dealt with by Mr. Thomas Fletcher, F.C.S., in an article which appeared in the *Architect* on Feb. 15 last. A case had come under his notice in which an "opinion" had been obtained on this matter, which had led to a number of flueless "chancel" gas-stoves, with atmospheric burners, being condemned after four years' constant use in a London chapel. The statements made against them were so plausible and neatly put, that they required consideration before their utter fallacy and incorrectness could be seen; and the facts were of very considerable importance, as they proved beyond question not only the conditions caused by flueless stoves, but also the comparative impurities from different sources, and the danger of attending crowded meetings. The alleged objections to the flueless stoves were: "That they generate thousands of cubic feet of carbonic acid, which is dangerous and unhealthy; "that the gas when burning pollutes the air with its own organic impurities;" "that the oxygen of the air in the room has fed the gas-heaters;" "that the sensation of welcome warmth prevents the badness of the atmosphere being at once recognized, but the carbonic acid gas will produce its effect on the congregation;" and "that the method of heating renders the air quite unfit for breathing." Mr. Fletcher inquired into these alleged defects, and set forth the results in the article referred to, from which the following extracts are made.

The building in question has a total floor surface of 47 feet by 41 feet. The average height being 24 feet, the cubic area is 46,248 feet. The average congregation numbers 600. The floor surface is consequently 3¼ square feet for each person, as against the 8-feet minimum for Board schools for infants. The cubic area for each person is 81 feet, as against 240 feet minimum for a registered common lodging-house. These data are taken from Dr. Whitelegge's text-book on "Hygiene and Public Health." The building is lighted by 96 gas-burners. The consumption of each is not given; but taking it at the low average of 3 cubic feet, the total consumption will be 288 cubic feet per hour for lighting only. The eight "chancel" stoves for warming each burns a maximum of 15 cubic feet per hour—a total of 120 cubic feet. But it must be noted that these are never used while the congregation are assembled; they are lighted for some hours in advance only.

Dealing first with the question of the production of carbonic acid, Mr. Fletcher points out, on the authority of the *Lancet*, that the amount of this impurity per cubic foot of gas is practically half the bulk of the gas burnt. The alleged "thousands of cubic feet" come down, therefore, to a total of 61 cubic feet per hour. Expired air from the lungs of an average person contains (as determined by Pettenkofer) 4·5 per cent. of carbonic acid; and each adult while awake gives off 0·8 cubic foot per hour. The 600 persons would consequently evolve 480 cubic feet of carbonic acid per hour; the warming-stoves, 61 cubic feet; and the lights, 147 cubic feet—a total of 688 cubic feet per hour. Allowing for absolutely no ventilation, the contamination of the atmosphere in one hour would be in carbonic acid by the congregation 1 in 100 parts; by the lighting, 1 in 331 parts; and by the heating-stoves, 1 in 797 parts—a total from all sources of 1 in 70, or equal to 1·43 per cent., less than one-tenth of this being formed by the heating apparatus. The normal quantity of carbonic acid in the air is 0·3 per 1000; but, as shown by the careful and exhaustive experiments of Dr. Haldane and Dr. Lorrain Smith, as recorded in the report of the British Association, if present in 100 times this amount, or 3 per cent., its presence is inappreciable except by chemical analysis, and its action is simply that of a diluent, like the nitrogen of the atmosphere. It is therefore evident that, in the complete absence of ventilation, the carbonic acid formed by every source is inappreciable.

Mr. Fletcher next disposes of the assertion that gas, when burning, "pollutes the air with its own organic impurity;" demonstrating clearly that its action is precisely the reverse of what is stated. He shows where the heat goes to. In average practice, he says, for every 1200 square feet of wall surface, in a room with ordinary ventilation, 660 British thermal units of heat are required for every 1° Fahr. rise from the normal; and allowing for the usual ventilation of a complete change of air every 20 minutes, 75 per cent. of the heat is lost by the walls and ceiling. If the air is changed only once every 40 minutes and the same temperature kept, 87 per cent. must be lost through the walls and ceiling. The figures will, of course, vary with every building; but as they are taken from careful experiments in rooms which are kept at the same temperature night and day constantly, it is clear that, under any possible circumstances, the actual warming of the air is almost a negligible function as compared with the loss by conduction through the walls. Mr. Fletcher thinks the system of calculating the heating power by the cubic area is one which needs to be discontinued, as being totally at variance with working results. The statement that "the sensation of welcome warmth" would probably "prevent the badness of the atmosphere being at once recognized," is, he says, absolutely contrary to facts.

Passing on to consider the extent of ventilation required, Mr. Fletcher remarks that this varies greatly. But if the average results are accepted as given in Whitelegge's "Hygiene," and also in "Box on Heat," at least 500 feet of fresh air per hour will be required for each person, with about one-tenth added for lights; making a total of 550 cubic feet for each person. The 600 people would, therefore, require 330,000 cubic feet of air passing through the building per hour. This would mean an entire change of air every 8½ minutes—an obvious impossibility, except with a powerful forced draught of warmed air. Taking the average figures given by Whitelegge as to natural ventilation, it is evident the building is enormously overcrowded; a change of air every 20 minutes being the maximum under ordinary circumstances without excessive draughts.

Mr. Fletcher says the actual cause of the offensiveness of the atmosphere of a room—and the explanation applies more or less to all public buildings—is the carbonic acid exhaled from the lungs of the occupants, accompanied as it is by other and dangerous matters. The effects of these are ascribed by technical persons to the "inert carbonic acid." Dr. Whitelegge's report on this point is clear. The moisture formed during the combustion of coal gas is perfectly sterile, and does not lend itself to the cultivation of bacteria. The moisture evolved by each person in a room will average 2½ oz. per hour—two-thirds of this being from the skin, and one-third from the lungs. Therefore, 93 lbs. weight of water per hour is discharged by the 600 persons assembled; and in the absence of most efficient ventilation, a large proportion of this condenses on the walls of the building. There can be no doubt that these are covered with organic matter and bacteria, and that the congregation is far too large for safety to health. Mr. Fletcher thinks the action of the heating apparatus, as regards the purity of the air, is so exceedingly small compared with the other causes, that it may be entirely ignored. The only possible emanations from the gas-flames are, he points out, a minute trace of sulphur, which may be appreciated occasionally, but which cannot, in the maximum possible proportion, be considered other than harmless; the other is carbonic oxide, which, if formed, is undoubtedly dangerous. But the experiments and analyses of Professor Vivian B. Lewes show that this is not formed when gas is burnt in a clear unobstructed flame.

Coming to the real defects of flueless gas-stoves, Mr. Fletcher points out the very curious fact that none of them were mentioned, either directly or indirectly, in the "opinion." He says their first and greatest defect is that they do not assist the necessary ventilation of the room. This defect they share with the hot-water pipes, and to a greater extent, because with the latter it is possible to make perforations in the wall behind the pipes—the incoming air being slightly warmed, while draughts are prevented. Secondly, this form of stove must, to prevent the formation of carbonic oxide, have flames which are clear and unobstructed by incandescent solid substances, which give a large proportion of radiant heat—an absolute necessity in rooms where persons are to be seated in comfort for any length of time. The last objection to flueless stoves, Mr. Fletcher says is peculiar to both these and paraffin oil stoves. They are the only sources of heat which do not dry the air of the room in which they are used. This is no objection in ordinary living-rooms, but is a decided one in shops where polished steel and similar goods are kept; and the balance for or against must be taken after consideration of the conditions needed. It would appear that, where no flue is available, they have a distinct advantage for many purposes; but their use is limited by objections which exist under certain conditions. It is evident, he says, that the "carbonic acid" and "pollution of the air" theories commonly held have no basis whatever in fact; and the objections are more mechanical than chemical.

With regard to heating and ventilation, Mr. Fletcher remarks that the problems connected therewith are usually calculated, even by architects and heating engineers, on the same basis—*i.e.*, the cubic air-space enclosed. This, he says, is perfectly correct for ventilation; but it has not the slightest relation to the heating power required. As already shown, the heat absorbed by air is so infinitesimal in quantity that it may be neglected; and the only matter needing attention is the heat absorbed by the walls, roof, and floor. As these bear a very close relation to each other in most buildings, it is only necessary to take the wall area as a basis; and the results of numerous experiments, on both a large and a small scale, show that, in an ordinary building without skylights, nearly one-half of a British thermal unit is absorbed by each square foot of wall surface per hour for every 1° Fahr. rise over the normal temperature maintained after the first warming up is complete. The building now specially in question has a wall surface of 4224 square feet; and for every 1° Fahr. rise of temperature to be maintained, 2112 units of heat will be absorbed—*i.e.*, the heating power of 3¼ cubic feet of ordinary 16-candle gas, or 32½ cubic feet for a rise of 10°. He points out that the actual consumption is nearly four times this—the preliminary heating up requiring the excess.

If the temperature were once attained throughout the building, and the heating continued steadily day and night, the gas consumption would be reduced 32½ cubic feet per hour for every 10° rise over the normal temperature. Applying this method of calculation to a smaller room—say, to one10 feet each way—the heating power required would be fully five times as great for the cubic area, owing to the larger proportionate area of wall surface; and this is undoubtedly the case in practice—an important point in the consideration of flueless stoves. The basis given for this in the chapel in question applies only to buildings of the same size; and the heating power required increases in direct proportion as the size of the building decreases.

From the foregoing considerations, Mr. Fletcher comes to the conclusion that the use of properly-constructed flueless gas-stoves in living-rooms cannot be in any way injurious to health, so far as pollution of the atmosphere is concerned. They are, under certain conditions, uncomfortable; but so long as these conditions are known, and guarded against as far as possible, the objections have, he says, little or no existence.

THE LEGAL ASPECT OF THE FROST QUESTION.

Now that irresponsible commentators have had their say, and now that Mr. Archibald Dobbs has lent his unaccustomed support to the legal position of the Water Companies, in regard to the great frost question, it may be well to glance at the only trustworthy legal sign-post—namely, that supplied by sundry judicial decisions.

It has been distinctly held that there was no liability where, by reason of a frost of a severity rarely felt in England, a fire-plug (which had resisted ordinary frost for twenty-five years) was forced out, and the water escaped from the main, but owing to the stopper above the plug being covered with ice and snow the water, instead of rising to the surface, was forced through the brickwork round the neck of the main, and made its way into the plaintiff's cellar, where it did damage. The principle of this ruling applies most appositely to many of the mishaps that occurred during the late wintry weather—viz., that a Water Company cannot be liable for accidents which arose from a frost of extraordinary severity, the effects of which no Company could by any possibility foresee or guard against. (See *Blyth v. The Birmingham Water-Works Company;* Exch. 781.) On the other hand, it has been laid down—and no one will quarrel with the doctrine—that, though not liable for the unforeseen results of an exceptional frost, a Company are bound to take reasonable care to provide against the consequences of ordinary frost. So, for example, there was held to be some evidence of negligence where it was known that the effect of frost would be to cause the plugs in the water-pipes to start, and thus to let the water out at the sides; and it was shown that some precautions might have been taken to prevent it or, at all events, to guard against the water escaping through the soil. In such circumstances, it was ruled that, even though the frost was of more than ordinary severity, there was some evidence on which a jury might hold the Company liable. (See *Steggles v. The New River Company;* 13 W. R. 413.)

The truth is that, in regard to the recent results of the hard frost, there has been manifested in some quarters a vehement wish to distort the legal position of the Companies, just as on some other occasions there have been sundry attempts to make the Companies insurers against loss by fire. The Companies are not insurers against the consequences of either fire or frost; and they are only liable where, in the particular circumstances of the case, negligence can properly be attributed to them. Long ago (in *Atkinson v. The Newcastle and Gateshead Water-Works Company;* "Weekly Notes," 23, June, 1877), it was judicially declared to be highly improbable that a Water Company, when applying to Parliament for statutory powers, and entering into a bargain with the Legislature as to the terms on which those powers should be granted, would be willing to accept as one of the conditions the liability of having to gratuitously insure against fire all buildings within their district of supply; and that it would be equally unreasonable to suppose that Parliament intended to impose that condition. Yet for such a condition, in regard to the effects of fire and frost alike, the present critics of the Companies, if they want to be logical, must needs contend. In the light of the decision quoted—it may be added in the light of calm reflection and common sense—the dark hints of Mr. Dobbs concerning the fell designs of dead and gone promoters of the Water-Works Acts, become simply ludicrous. Nor need much more importance be attributed to the official head-shakings of Mr. Shaw Lefevre, even with the shadow of the Law Officers looming large behind him.

Professor Lewes at the Royal Society.—On two occasions last month, Professor Lewes appeared before the Royal Society with contributions of special interest to the gas industry. His first paper, read on the 7th ult., was on the subject of "The Action of Heat upon Ethylene;" and it was in continuation of the important communication made by him to the Society's Proceedings last year, and reprinted in the JOURNAL at the time. This paper we give in another column. The second, read on the 21st ult., was on "The Cause of Luminosity in the Flames of Hydrocarbon Gases." This is in type; but we are compelled to hold it over till next week.

NOTES.

Blondel's "Lumen-Metre."

M. Blondel, whose researches into the problems of lighting have on previous occasions been mentioned in the JOURNAL, recently brought under the notice of the Académie des Sciences an apparatus designed by himself (and constructed by Messrs. Sautter and Harlé) for permitting of the measurement of the mean spherical intensity of any source of light. M. Blondel observes that it has hitherto only been possible to effect this determination in special cases, and by the employment of a tedious and indirect method due to M. Allard. The mean spherical intensity of a light is in effect equal to $\frac{1}{4\pi}$ of the total flux of the source. It may or may not equal the illuminating power of the light determined in the ordinary way by observing its radiation in a single direction by the aid of a photometer. But the fact that different artificial light-sources give maximum and minimum effects in different directions, lends a degree of uncertainty to such determinations, which would be avoided if we could take a direct measurement of their mean spherical intensity. M. Blondel's instrument for effecting this object is called by him a "Lumen-Metre." It consists of a hollow sphere of metal, with blackened interior, in the centre of which the light to be measured can be placed. The sphere is split into two unequal segments; providing an annular slot, through which the rays of light are able to escape all round the source of light. These rays are then received upon, and reflected by, a suitably disposed annular reflector, which projects them upon a translucent screen, where the illuminating power is measured by a photometer in the ordinary way. By this means, M. Blondel states that the average spherical intensity of the light can be determined at once and directly. The apparatus is specially intended for use with electric arc lights, the spherical intensity of which is commonly a matter of uncertainty.

Water Supplies by Meter.

The subject of water supplies by meter has been brought once more into prominence in connection with the recent frost, and the great waste of water ensuing thereupon. It is, therefore, interesting to note that a discussion of the whole subject of the waste of water in towns, and the meter system as a remedy, was discussed at a recent meeting of the New England Water-Works Association. Mr. J. C. Haskell, Superintendent of the Lynn (Mass.), Water-Works, read a paper recommending the metering of every service as the best preventative of waste. Mr. Dexter Brackett, however, offered some data to show that the general adoption of water-meters would not necessarily result in the production of an ideal state of things in this regard. He cited the case of a city of 30,000 inhabitants, having 3250 taps and 3148 meters, where the average daily consumption of water, according to the pumping, was 75 gallons per consumer. On the other hand, all the water being metered, the meter indices showed a consumption of 25 gallons per head for manufacturing purposes, and 24 gallons per head for domestic use. That is to say, the meter record showed a consumption of 49 gallons, and the pumps a demand of 75 gallons per head per day; and there was no accounting for the difference. Mr. Fuller, of Wellesley, Mass., said that a great deal of the waste in the town was corrected by the introduction of meters. There was a minimum charge for a stated consumption; all excess being charged for. Other engineers gave it as their experience that all water-meters register in favour of the consumer, who has consequently nothing to complain of on this score.

Considerations of Luminous Efficiencies.

According to Professor Dewar, the luminous efficiency of candle, oil, and coal-gas flames, as compared with the heating effect, is as 2 : 98. He makes no distinction for different kinds of lamps or burners, and gives no sign of acquaintance with the fact that the same oil (and especially the same gas) burnt for lighting effect under different conditions, yields various returns in luminous effect for the same consumption. Professor Dewar credits the incandescent electric lamp with a duty of 5 per cent. of light to 95 per cent. of heat, which is not such a great superiority to lights of combustion as might have been expected. The arc lamp he took to give 10 per cent. of light to 90 per cent. of heat; the magnesium light, 15 per cent. of light to 85 per cent. of heat; the sun, 30 per cent. of light to 70 per cent. of heat; and the Cuban firefly (the most economical light known) was credited with giving 99 per cent. of light to a doubtful 1 per cent. of heat. It appears reasonable to regard these figures as being little better than approximations; and it is to be desired that the subject should be fully investigated afresh by the aid of modern physical appliances. Some work has been done in this direction by Dr. E. L. Nichols and others, notably in elucidating the question whether in incandescent electric lamps, a bright or a black filament possesses the higher light-radiating power. Mr. Evans, in 1886, thought he had proved that the proportion of light rays to non-luminous ones was much larger with a filament possessing a bright, metallic-looking surface than from one having a black surface. Professor Weber has stated the contrary. Mr. Shedd found, from spectro-photometric measurements, that the light of lamps with filaments of untreated vegetable fibre was of the same colour as that of an Argand gas-burner when the lamp was being worked at 6·8 watts per

candle. All efficiencies lower than this showed a redder light, and all higher efficiencies a bluer light, than the gas. In the case of treated filaments with bright surface, on the other hand, equality with gas-light as regards whiteness was only reached at somewhat higher efficiencies, of between 4 and 6 watts per candle. Dr. Nichols has also investigated the performances of lamps with dull and bright filaments; and he concludes that the distribution is different in the two cases, and that bright filaments are superior in light-production, as stated by Evans.

The Prepayment Gas-Meter Company, Limited.—In another part of the JOURNAL will be found the prospectus of the above Company, which has been formed to acquire and work a patent (No. 12,184 of 1893) granted to, and hitherto owned by, Mr. R. W. Brownhill, of Birmingham, for automatic prepayment sale and delivery attachments for gas and liquid meters for the United Kingdom and (when applied for and obtained) the United States and Canada; together with all previous patents granted to him or relating to penny-in-the-slot meters, and the benefit of the royalties reserved by two licences given in respect of one of these previous patents. The capital is £75,000, in £1 shares, of which 65,000 are offered for subscription. The purchase price is £50,000, whereof £5000 is to be in cash, and the balance in cash or shares. The remaining 25,000 shares are reserved for working capital. It will be noticed that among the Directors are Major W. F. Gordon, a member of the Board of the Bombay Gas Company, and Mr. G. B. Cliff, the Chairman of the Northwich Gas Company.

A Portable Incandescent Lamp.—A patent has been secured in Germany for an incandescent lamp in which the fuel is benzine. The wick-holder is sufficiently heated by a small jet to vaporize the ascending benzine; and after mingling with air, the vapour burns with a non-luminous flame. A mantle placed in this flame glows as in the ordinary Welsbach light. Professor Glasenapp, of Riga, finds that the lamp gives a light of 46 candles with a consumption of 670 grains of benzine per hour. At local prices, the cost of one candle-hour is 30 per cent. higher with a petroleum lamp than with the new benzine burner. The products of combustion, on the same basis, of the benzine lamp are one-fifth the volume of those of the petroleum lamp; and the heat developed is in even lower proportion. On the other hand, the fragility of the mantle necessitates great care in carrying the lamp; and the risk of fire in the employment of so volatile a fluid as benzine is considerable. The *Zeitschrift für Beleuchtungswesen* considers the invention interesting, if only as the result of an attempt to grapple with the problem of illumination from new ground.

The Rarer Metals and their Alloys.—This was the subject of a discourse by Professor Roberts-Austen, F.R.S., at the Royal Institution on the 15th inst. He pointed out that metals were not the dull quiescent things they were usually supposed to be, as a very slight rise in temperature would excite in them intense molecular movements. These movements could readily be detected and measured by methods which had proved to be so fruitful when applied to the study of living things. Passing to the rarer metals, Professor Roberts-Austen stated that they might be divided into two classes—those of the platinum group, which occurred in Nature in the metallic state, and those which were usually found as oxidized compounds. Professor Roberts-Austen described and illustrated by very careful experiments the methods of reducing oxides of titanium, molybdenum, vanadium, and uranium in the electric furnace at a temperature of 3500°, which had recently been employed in France by M. Moissan, who had sent for the purpose of the lecture beautiful specimens of these metals. It was pointed out that on no previous occasion in the history of the Royal Institution had such a collection of rare metals been seen.

Electric Lighting on Railways.—At the meeting of the Institution of Electrical Engineers, last Thursday (the President, Mr. R. E. Crompton, in the chair), a paper was read on the "Employment of the Electric Light for Railway Purposes," by Mr. W. E. Langdon. The Midland Company, he said, were the first to apply the electric light for traffic. The Great Western, the London and South-Western, the Brighton, the Lancashire and Yorkshire, the Caledonian, the Manchester, Sheffield, and Lincolnshire, the Glasgow and South-Western, the Great Northern, and the Great Eastern, had all adopted it; and the London and North-Western Company were now applying it to their goods depôts. Most of these were comprehensive schemes, the product of men of large experience and of the highest ability. Incandescent lighting had so far found its chief employment in spaces of limited area, and particularly where a staff of workers was in constant attendance. Arc lighting had been of the utmost advantage in railway working, especially in the loading and unloading of stocks, and in the marshalling of trains it was an invaluable adjunct. In no place was the electric light more valuable than in yard shunting and on the marshalling-grounds. With a brilliant light at the junction points, the operations might be carried on with almost the same despatch as in broad daylight. Risk to life and limb was reduced; while the electric light had been found useful in preventing petty pilfering. In the relative cost of working, the author said the advantage was so largely in favour of the electric light as to more than compensate for the first outlay.

TECHNICAL RECORD.

THE ACTION OF HEAT UPON ETHYLENE.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

SECOND PAPER.

[Communicated to the Royal Society through Professor Thorpe, and read by the Author on March 7, 1895.]

In a paper communicated to this Society in the spring of 1894,* I showed that ethylene, when subjected to heat, was converted into acetylene and methane, according to the equation—

$$3C_2H_4 = 2C_2H_2 + 2CH_4;$$

and that the acetylene so formed either at once polymerized, forming a large number of secondary products, or else decomposed to carbon and hydrogen, according to the temperature at which the action was being carried on.

The fact that ethylene is one of the principal products in many cases of destructive distillation, renders a knowledge of the conditions affecting these changes of considerable importance; and the experiments described in this paper were made with the view of ascertaining the effect of rate of flow, area of heated surface, and dilution upon the changes taking place.

The apparatus and methods of analysis employed were the same as described in the former paper, with the exception that a platinum tube, 14 millimetres in diameter and 73·6 centimetres long, was used as the decomposing chamber, and that an easily regulated gas-combustion furnace was employed as the source of heat. The temperature of the gas in the tube was measured, as before, by the Le Chatelier thermo-couple; and every precaution was taken to keep it constant during the experiments.

The ethylene in each case was prepared by heating a mixture of 25 parts by weight of alcohol and 150 parts of strong sulphuric acid—purifying, and storing in a large glass holder.

The first set of experiments was to ascertain the influence of area of heated surface upon ethylene when passing through a tube heated to the temperature most often employed in the destructive distillation of coal and hydrocarbon oils, and also to find the result of varying the rate at which the gas was passed through the zone of heat.

TABLE I.—*Influence of Rate of Flow and Length of Heated Surface upon the Amount of Ethylene Decomposed. Temperature, 900° C.; Rate of Flow, 5 c.c. per Minute.*

Length of tube heated	1 inch.		6 inches.		18 inches.	
Volume of gas—						
Before heating	525		625		625	
After „	490		653		670	
Analysis of Gaseous Products.	Per Cent.		Per Cent.		Per Cent.	
Carbon dioxide	0·75		0·50		0·75	
Oxygen	0·50		0·25		1·00	
Unsaturated hydrocarbons	17·80		10·75		2·75	
Carbon monoxide	2·21		1·75		1·75	
Saturated hydrocarbons—						
By absorption	11·25	46·87	9·50	60·75	12·22	65·42
By explosion	35·62		51·25		53·20	
Hydrogen	24·12		22·75		24·00	
Nitrogen	7·75		3·25		4·33	

On now calculating the percentage for the change in volume, we obtain the following figures:—

Unsaturated hydrocarbons	16·60	11·25	2·94
Saturated hydrocarbons	43·72	63·42	70·13
Hydrogen	22·50	23·75	25·72

The original gas, however, only contained 96·7 per cent. of ethylene; so that the percentages of unsaturated hydrocarbons decomposed are: 1-inch tube, 80·1; 6-inch tube, 85·48; 18-inch tube, 93·76.

TABLE II.—*Temperature 900° C.; Rate of Flow, 15 c.c. per Minute.*

Length of tube heated	1 inch.		6 inches.		18 inches.	
Volume of gas—						
Before heating	683		600		600	
After „	615		515		640	
Analysis of Gaseous Products.	Per Cent.		Per Cent.		Per Cent.	
Carbon dioxide	0·20		1·00		0·50	
Oxygen	0·50		0·50		0·75	
Unsaturated hydrocarbons	28·75		20·15		6·00	
Carbon monoxide	1·50		1·50		1·75	
Saturated hydrocarbons—						
By absorption	8·80	42·25	9·43	51·80	19·22	56·72
By explosion	33·45		42·37		37·50	
Hydrogen	21·15		20·55		28·75	
Nitrogen	5·65		4·50		5·53	

On now calculating the percentage for the change in volume, we obtain the following figures:—

Unsaturated hydrocarbons	25·87	17·28	6·39
Saturated hydrocarbons	38·02	44·44	60·46
Hydrogen	19·03	17·63	30·64

The original gas contained 96·7 per cent. of ethylene; so that the percentages of unsaturated hydrocarbons decomposed are: 1-inch tube, 70·83; 6-inch tube, 79·42; 18-inch tube, 90·31.

*Roy. Soc. Proc., Vol. LV., p. 90; JOURNAL, Vol. LXIII., pp. 329, 381, 436.

TABLE III.—*Temperature*, 900° C. *Rate of Flow*, 40 *c.c. per Minute.*

	1 inch.	6 inches.	18 inches.
Length of tube heated .			
Volume of gas—			
Before heating . .	870	1050	1000
After „ . .	790	985	980
Analysis of Gaseous Products.			
	Per Cent.	Per Cent.	Per Cent.
Carbon dioxide . . .	0·75	0·50	0·25
Oxygen	0·50	0·75	0·50
Unsaturated hydrocarbons	50·80	35·75	9·75
Carbon monoxide . .	1·50	1·00	1·50
Saturated hydrocarbons—			
By absorption . .	11·22	11·25	10·00
By explosion. . .	16·45 } 27·67	30·50 } 41·75	46·50 } 56·50
Hydrogen	14·50	16·65	28·00
Nitrogen	4·28	3·60	4·00

Calculating the percentage for the change in volume, we obtain the following figures :—

Unsaturated hydrocarbons . .	46·12	33·53	9·55
Saturated hydrocarbons . . .	25·12	39·16	55·37
Hydrogen	13·16	15·61	27·44

The original gas contained 96·7 per cent. of ethylene ; so that the percentages of unsaturated hydrocarbons decomposed are : 1-inch tube, 50·58 ; 6-inch tube, 63·17 ; 18-inch tube, 87·15.

On collecting these results in one table, we have—

Percentage of Ethylene Decomposed.

Length of tube heated .	1 inch.	6 inches.	18 inches.
5 c.c.	80·10	85·48	93·76
15 c.c.	73·83	79·42	90·31
40 c.c.	50·58	63·17	87·15

The first thing that strikes one is the enormous amount of decomposition which takes place in the first inch of flow through the heated tube, and the small effect which an increase in the length of the heated surface has upon the further decomposition of the unsaturated hydrocarbons. This result might be caused by the methane and hydrogen formed during the decomposition diluting the remaining ethylene, and so rendering the decomposition more difficult. It may also arise from secondary actions taking place among the primary products, and again forming ethylene ; or it may be due to both these causes acting together.

In order to trace the effect of dilution, a series of experiments was made, in which ethylene, diluted with hydrogen, was passed through 6 inches of the same tube as was used in the previous experiments, heated to the same temperature, and under precisely similar conditions. The store holder of ethylene used for making the mixture contained a gas which gave, on analysis : Ethylene, 97·85 per cent. ; nitrogen, 2·00 per cent. ; oxygen, 0·15 per cent.

TABLE IV.—*Influence of Dilution in Checking Decomposition of Ethylene. Length of tube heated, 6 inches ; Temperature*, 900° C. ; *Rate of Flow*, 10 *c.c. per Minute.*

Percentage of hydrogen.	nil	10·0	25
„ ethylene .	98·7	90·0	75
Volume of gas—			
Before heating . .	100·0	100·0	100
After „ . .	81·3	69·5	69
Analysis of Products of Decomposition.			
	Per Cent.	Per Cent.	Per Cent.
Carbon dioxide . . .	1·00	0·75	0·50
Oxygen.	0·50	0·25	0·25
*Unsaturated hydrocarbons	32·52	31·00	29·00
Carbon monoxide . .	1·00	1·25	1·00
Saturated hydrocarbons—			
By absorption . .	17·75	14·50	14·50
By explosion. . .	32·50 } 50·25	36·25 } 50·75	33·95 } 48·45
Hydrogen	12·62	14·25	18·50
Nitrogen	2·11	1·75	2·30
*Containing acetylene .	1·06	0·52	0·73
Percentage of hydrogen.	50	75	95
„ ethylene .	50	25	5
Volume of gas—			
Before heating . .	100	100	100
After „ . .	64	85	100
Analysis of Products of Decomposition.			
	Per Cent.	Per Cent.	Per Cent.
Carbon dioxide . . .	1·25	0·50	—
Oxygen	—	0·15	—
*Unsaturated hydrocarbons	22·25	11·10	2·00
Carbon monoxide . .	1·25	1·00	0·50
Saturated hydrocarbons—			
By absorption . .	8·50	5·50	0·75
By explosion . .	27·50 } 36·00	10·30 } 15·80	4·10 } 4·85
Hydrogen	37·15	68·45	89·15
Nitrogen	2·10	3·00	3·50
*Containing acetylene .	0·32	0·15	trace

On calculating these percentages for the change in volume, we obtain the following results :—

	I.	II.	III.	IV.	V.	VI.
Unsaturated hydrocarbons. . . .	25·58	21·18	19·50	14·04	9·30	2·00
Saturated hydrocarbons	40·85	35·27	33·43	23·04	13·43	4·85

The ethylene taken only contained 97·85 per cent. of the hydrocarbon ; hence—

	I.	II.	III.	IV.	V.	VI.
Unsaturated hydrocarbons originally present	97·85	88·02	73·35	48·90	24·45	4·89
Unsaturated hydrocarbons present after heating . .	25·58	21·18	19·50	14·02	9·30	2·00
Unsaturated hydrocarbons decomposed	72·27	66·84	53·85	34·88	15·15	2·89

Calculating this to the percentage of the total ethylene decomposed, we have—

I.	II.	III.	IV.	V.	VI.
73·86	75·94	73·24	71·30	61·96	59·10

This shows that dilution has practically no effect in retarding the decomposition until 75 per cent. of diluent is present, and also clearly points to its being radiant heat, and not contact with the heated sides of the tube, which is responsible for the largest proportion of the decomposition ; as, had contact been the active factor, dilution, by reducing the number of impacts of the hydrocarbon molecules with the heated surface, would have shown a considerable decrease in decomposition.

Some information can be obtained as to the secondary reactions which accompany the main decomposition by studying the proportions in which the products other than ethylene are present in the gases after heating.

Taking the experiments made upon the effect of length of heated tube and rate of flow, and tabulating the percentages of saturated hydrocarbons and hydrogen corrected for change of volume, we obtain the following results :—

Saturated Hydrocarbons.

Length of tube heated .	1 inch.	6 inches.	18 inches.
5 c.c.	43·72	63·42	70·13
15 c.c.	38·02	44·44	60·46
40 c.c.	25·12	39·16	55·37

The temperature employed in these experiments is not sufficiently high to cause any large amount of the methane to decompose ; so that the volume should, according to theory, approximate to two-thirds of the ethylene decomposed.

	Rate of Flow per Minute.	Ethylene Decomposed.	Methane Found.	Methane Calculated.	Variation.
(1)	5 c.c.	80·10	43·72	53·40	−9·68
	15 c.c.	70·83	38·02	47·22	−9·20
	40 c.c.	50·58	25·12	33·72	−8·60
(2)	5 c.c.	85·48	63·42	56·98	+6·44
	15 c.c.	79·42	44·44	52·94	−8·50
	40 c.c.	63·17	39·16	42·12	+2·96
(3)	5 c.c.	93·76	70·13	64·50	+5·63
	15 c.c.	90·31	60·46	60·20	+0·26
	40 c.c.	87·15	55·37	58·10	−2·73

(1) 1 inch of heated tube ; (2) 6 inches do. ; (3) 18 inches do.

The fact that when only 1 inch of tube is heated there is a fairly constant deficit of the kind to be expected at the temperature employed, and that when a greater length of heated tube is used, with a 5 c.c. rate of flow, the deficit becomes a substantial surplus, at once suggests that methane is among the secondary as well as the primary products of decomposition.

In the dilution experiments, the larger contraction in the volume noticeable points to the diluting of the products favouring polymerization.

Dilution.	Ethylene Decomposed.	Methane Found.	Methane Calculated.	Variation.
Nil . . .	72·27	40·85	48·18	−7·33
10 per cent..	66·84	35·27	44·56	−9·29
25 „ .	53·85	33·43	35·90	−2·47
50 „ .	34·88	23·04	23·24	−0·20
75 „ .	15·15	13·43	10·10	+3·33
95 „ .	2·89	4·85	1·92	+2·93

It seems probable from the figures that, when dilution reaches above 50 per cent., not only is decomposition of the methane retarded, but formation as a secondary product commences.

Ever since water gas has been in use, it has been well known that it contained traces of methane and acetylene, under conditions which render it impossible for them to have been formed from hydrocarbons remaining in the incandescent fuel ; and the probabilities are that they have been produced—the acetylene by direct combination of carbon and hydrogen, and the methane by its partial decomposition.

The formation of ethylene from nascent hydrogen and acetylene takes place at such temperatures as those employed ; and the amount so formed and again broken up by the radiant heat is purely a function of mass. So that I conceive, from these experiments, that the ethylene at once to a great extent decomposes under the influence of sufficiently high radiant heat according to the equation—

$$3C_2H_4 = 2C_2H_2 + 2CH_4 ;$$

and that the acetylene partly decomposes—the nascent hydrogen again uniting with more acetylene to reproduce ethylene, while other portions of the acetylene polymerize to benzene and other more complex hydrocarbons, and that, if the flow of this mixture be continued through a heated chamber, the action continues, the amount of ethylene regenerated becoming less and less, until it ceases to exist as a product of the decomposition.

It is well known that hydrogen will diffuse through ignited

platinum into a vacuous space or even into other gases; and though no change in volume was observed when a mixture of 95 per cent. of hydrogen and 5 per cent. of ethylene was passed through the tube heated to 900° C., it seemed advisable to make special experiments to ascertain if any loss of hydrogen from this cause did take place at the temperature employed.

The apparatus having been fitted up as before, 6 inches of the tube were heated to between 900° and 1000° C., and a carefully measured volume of pure hydrogen was made to pass through it three times at a slow rate of flow, with the result that, after being brought back to its original temperature and pressure, it measured 99·5 per cent. of the volume taken—showing that error from this cause is not likely to have taken place.

A new series of experiments was now undertaken to ascertain, if possible, how increase of contact with the heated walls of the containing vessel affected the amount and character of the decomposition taking place. In order to do this, a small platinum tube 2·5 mm. in diameter and 45·72 cm. long was taken in place of the one used in the previous experiments, which was 14 mm. in diameter. The area of the big tube, therefore, as compared with the area of the small tube, was as 1·54 : 0·049; and in order to obtain the relative amount of decomposition, it is manifest that the rate of flow must be the same in both tubes.

If the rate of flow in the big tube be 40 c.c. per minute, then

$$\frac{2{\cdot}5^2 \times 40}{14^2} = 1{\cdot}27$$

will give the required rate for the small tube.

TABLE V.—*Temperature*, 900° *C.*; *Rate of Flow*, 1·27 *c.c. per Minute.*

Length of tube heated	1 inch.		6 inches.		12 inches.
Volume of gas—					
Before heating	100		100		100
After "	80		91		97
Analysis of Gaseous Products.					
Carbon dioxide	1·00		0·75		0·75
Oxygen	0·25		0·00		0·25
*Unsaturated hydrocarbons	15·30		12·20		6·30
Carbon monoxide	0·75		1·00		1·00
Saturated hydrocarbons—					
By absorption	13·50	50·50	12·10	60·30	9·50	54·50
By explosion	37·00		48·20		45·00	
Hydrogen	26·00		18·75		30·80
Nitrogen	6·20		7·00		6·40
*Containing acetylene	0·30		0·32		0·20

Correcting the unsaturated hydrocarbons for change in volume, we obtain undecomposed 12·00, 10·81, and 5·92. The ethylene used contained 96·75 per cent. of unsaturated hydrocarbons; therefore the amount decomposed is 84·75, 85·94, and 90·83.

Turning now to the experiments made with the large tube and 40 c.c. a minute rate of flow, we find that the percentage of ethylene decomposed was: 1-inch tube, 50·58; 6-inch tube, 63·17; 12-inch tube, 75·16 (calculated)—an increase of decomposition with the small tube amounting to the following percentages: 33·93, 22·48, and 15·48. This shows that the maximum increase of 34 per cent. rapidly falls with increased length of flow, while the ratio of area of heated surface to the passing gas is 43·96 : 7·85, or 5·6 times as great in the small tube as in the large, yet only gives an increase of one-third at most in the decomposition.

From the results of these experiments, it may be stated that—

(1) The initial decomposition of ethylene by heat is very rapid, and requires but a short flow through a heated containing vessel; such primary decomposition, however, being but slowly completed, owing to secondary reactions, which tend to re-form ethylene.

(2) Dilution has but little effect in retarding the decomposition of ethylene, unless it be very large.

(3) Increase in rate of flow diminishes the amount of decomposition when the heated area is small, but rapidly diminishes in effect as the length of flow through a heated area increases.

(4) The decomposition of ethylene is chiefly caused by radiant heat, the effect of which is very great as compared with the decomposition due to contact with heated surfaces.

[I desire to acknowledge the valuable aid given me by Mr. F. B. Grundy in this investigation.]

A New Mantle for Incandescent Lighting.—A Breslau inventor, Herr M. Baum, proposes to form a mantle for incandescent lighting by treating vegetable fibres with ammonium phosphate and the chlorides of ammonium, calcium, and magnesium. By heating, the ammonium salts are partially volatilized; and a deposit of calcium phosphate and ammonium phosphate remains. The threads then receive a protecting coat of a gelatinous mixture.

Securing Gaseous Occlusion in Coal.—To prevent the deterioration which takes places in coal when stacked in the ordinary manner, it has been proposed, in the case of a large quantity having to be stored for a considerable period, to try the effect of submerging it in a sufficient depth of water to give the necessary pressure for confining the gas within the pores. It is further suggested that, to prevent loss of gas in transit, coal might be conveyed, while remaining submerged, by the numerous canals and navigable rivers which are now being rehabilitated in the various countries of Europe.

THE COMPOSITION OF THE EXTINCTIVE ATMOSPHERES PRODUCED BY FLAMES.

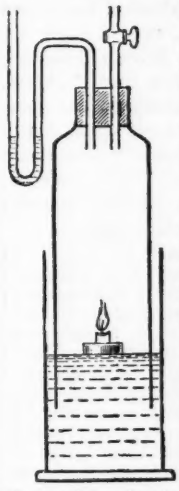
By FRANK CLOWES, D.Sc., Lond.

[A Communication made to the Royal Society, Feb. 7, 1895.]

In a former paper,* the author communicated the results obtained by mingling gases which were extinctive of flame, with air, until a flame burning in the air was just extinguished. The gases used in the experiments were carbon dioxide and nitrogen. Each of these gases was separately introduced into the air; and the composition of the atmosphere thus produced, which just extinguished flame, was determined by chemical analysis. The general results arrived at were—

1. That wick-fed flames require atmospheres of very similar composition to extinguish them; while gas-fed flames require atmospheres of widely different composition.
2. That nitrogen must be added in larger proportion than carbon dioxide, in order to extinguish the same flame.
3. That the minimum proportion of extinctive gas which must be mingled with air in order to extinguish a flame, is independent of the size o the flame.

A supplementary series of experiments has now been undertaken in order to determine the composition of the atmosphere extinctive of each flame, which is produced by the flame itself when burning in an enclosed volume of air at atmospheric pressure. Preliminary trials showed that, in order to secure trustworthy results, the atmosphere must not be in contact with water. It was further found necessary to avoid change of pressure in the enclosed atmosphere during the combustion of the flame. These necessary conditions were complied with by allowing the flames to burn in a bell-jar, the bottom of which was closed by dipping into a sufficiently deep vessel of mercury. The neck of the bell-jar was closed by a cork bearing a U-shaped mercury gauge, and a glass tube with a stopcock.



While the flame was burning, the pressure of the air within the bell-jar was maintained uniform by raising or lowering the bell-jar sufficiently to maintain the mercury levels unchanged in the pressure-gauge. As soon as the flame was extinguished by the atmosphere around it, the vessel was allowed to stand until the atmosphere within had become uniform in temperature with the air around. A portion of the gases within the bell-jar was then removed by means of the stopcock-tube to a Hempel gas-burette, and was subjected to ordinary volumetric analysis by absorption. Each experiment and analysis was repeated in duplicate, and frequently in triplicate. The results obtained were either identical or closely concordant, except in the case of methane; but the flame of ethylene could not be maintained under the conditions of the experiment. The gas was burnt from a tube passing through the mercury, and terminating in a jet just above the surface of the mercury. The liquids were burnt from wicks contained in small shallow vessels floating upon the surface of the mercury.

As in the previous series of experiments (*loc. cit.*), the combustible substances used were chiefly those which are burnt for ordinary heating and lighting purposes. The mean results are tabulated below :—

Percentage Composition of the Residual Atmosphere and of the Artificial Atmosphere in which Flame is just Extinguished.

Combustible Substances Burnt.	Percentage Composition of the Residual Atmosphere in which the Flame was Extinguished.			Proportions per Cent. of O_2 and N_2 in which Flame is Extinguished when Introduced.	
	O_2.	N_2.	CO_2.	O_2.	N_2.
Alcohol, absolute	14·9	80·7	4·35	16·6	83·4
Alcohol, methylated	15·6	80·25	4·15	17·2	82·8
Paraffin, lamp oil	16·6	80·4	3·0	16·2	83·8
Colza and paraffin	16·4	80·5	3·1	16·4	83·6
Candle	15·7	81·1	3·2	16·4	83·6
Hydrogen	5·5	94·5	..	6·3	93·7
Carbon monoxide	13·35	74·4	12·25	15·1	84·9
Methane	15·6	82·1	2·3	17·4	82·6
Ethylene (failed)	..	..	..	[13·2	86·8]
Coal gas	11·35	83·75	4·9	11·3	88·7

In the above table, the results are given which were obtained by the analysis of the residual atmospheres in which the flame had burnt until it was extinguished. Since the proportions of carbon dioxide contained in these atmospheres are small, the composition of the artificial atmospheres consisting of nitrogen and oxygen only in which the flames were just extinguished when they are inserted, are also stated for comparison. It will be noticed that the general agreement in composition shown by the two classes of extinctive atmospheres, so differently produced, is well maintained; and, when the conditions of the experiments are taken into account, the recent series of results

* *Roy. Soc. Proc.*, Vol. LVI.

are confirmatory of the general accuracy of those that were previously obtained.

After acknowledging the assistance rendered to him by Mr. M. E. Feilmann, B.Sc., in carrying out the experimental work involved in the above investigations, Professor Clowes proceeds, in a subsequent communication (dated Feb. 18), to show how closely the composition of the extinctive atmosphere produced by the flame of a candle or of oil or alcohol corresponds with the average composition of the air expired from the lungs. The conclusions drawn from these experiments are that: 1. The flames of the combustible gases and liquids which were experimented upon, produce, at the point of extinction in an enclosed atmosphere, a change in the proportion of oxygen in the air generally corresponding to that produced by preparing extinctive atmospheres by artificial mixture. 2. The flames of candles and lamps, when they are extinguished by burning in a confined space of air, produce an atmosphere of almost identical composition with that of air expired from the lungs. 3. The extinctive atmospheres produced by the combustion of the flames of candles and of lamps, and the air expired from the lungs after inspiring fresh air, are respirable with safety. 4. The extinction of an ordinary candle or lamp flame is not necessarily indicative of the unsuitability of an atmosphere to maintain life when it is breathed.

MR. JOHN WEST ON ECONOMICAL LIGHTING.

At the Meeting of the Manchester Association of Engineers last Saturday, Mr. JOHN WEST, M.Inst.C.E., read a paper on "The Economical Lighting of Public and Private Buildings, Workshops, &c." Our readers may remember that Mr. West, in the course of his address to The Gas Institute last year, suggested that gas engineers should give lectures upon, and in other ways bring before the public, the question of the economic lighting of public and private establishments. This advice Mr. West is now himself carrying out; and we give below a full abstract of his communication on this important subject.

The author began by remarking that, though the use of gas has become general, on account of its purity and cheapness for lighting and heating purposes, it is perfectly well known to the faculty that few people use the most efficient and most economical means for obtaining the maximum amount of light contained in the gas. Being convinced that there is a great loss of money to the community generally through the use of defective appliances, and that the best mode of consuming gas for obtaining efficiently and economically its highest illuminating power is still, by many, very imperfectly understood, he thought the Association would be carrying out their object if they investigated the cause of this, and explained the best-known principles of regulating and developing the most light from a given quantity of gas, by which means pecuniary and other advantages might be derived.

Mr. West then went on to say that gas is produced of different qualities throughout the United Kingdom, varying in illuminating power from 12 to 28 candles. In a large number of the provincial towns in England, it ranges from 12 to 15 candles; in London, it is 16 candles; and in Manchester and other places nearer the cannel-fields, it ranges from 15 to 20 candles. In Scotland, where they are close to the cannel-seams, it is made in some cases as high as 28 candles. He next explained the method by which the gas is tested; illustrating his remarks by means of a photometer which he had procured for the purpose. In this connection he mentioned that there are now 22 stations in and round London where the gas is daily tested by experts, in order to ascertain if the Companies are delivering to the consumers gas of the illuminating power and purity prescribed by Act of Parliament.

The author then proceeded to show the different ways in which gas is consumed. Taking first of all the ordinary fishtail or batswing burner, he called attention to the fact that, using the same quality of gas, there was a great difference in the illuminating power. In one, there were splendid yellow bands, giving forth innumerable rays of light; whereas in the other these bands were not so visible. He explained that the cause of the difference in the flames was a chemical question, and then proceeded to enlighten his audience on the phenomena of combustion and flame; demonstrating that the blue portion in the flame of a candle was in a gaseous state, but was not giving light. Passing on to the subject of burners, he said that, about thirteen years ago, he obtained, for the purpose of comparison, a large number of burners that were being used by the ordinary consumers in Manchester, and tested them against several new burners that were obtainable. He found that the loss of illuminating power by the use of the old burners amounted in most cases to more than 30 per cent.; and he feared, from observations he frequently made, that, from want of knowledge in many cases, this loss was still going on.

The next section of the paper was devoted to a consideration of the results of the distillation of coal for the production of gas. Mr. West explained that in gas as supplied for consumption there are about nine different compound substances, which may be classed broadly into the light-giving and heat-giving portions. Measuring gas by volume, the light-giving constituents form a very small percentage of the whole bulk; the principal of which is made up of hydrogen. The light-giving compounds, he went on to show, consist entirely of carbon and hydrogen in a state of chemical union; both of them having an affinity for oxygen. He illustrated the effects of incomplete combustion, and described the chemical changes that occur when it is fairly complete. He pointed out that the brilliant yellow bands noticeable in luminous flames are due to the existence of a great multitude of infinitely small particles of carbon raised to a great heat. The important part played by heat in promoting the luminosity of gas-flames was, he said, well exemplified in the extraordinary illuminating power of the various improved regenerator burners now upon the market.

The next matters touched upon were pressure and air supply, the regulation of which, the author pointed out, is very necessary in order to obtain the maximum amount of light contained in gas. This principle has been worked out in modern burners. He emphasized the fact that, if air is forced into a flame, it destroys its illuminating power; and, on the other hand, if gas is driven boisterously into the atmosphere, similar results follow. He showed that it is the different ways in which the gas issues from the various burners which cause the difference in the amount of light. In one case, we have burners which require more pressure to force the gas through the smaller orifices; in another, the gas streams gently into the air, and quietly draws to itself the necessary amount of oxygen. In the latter condition, we get the most light from the gas. In the standard Argand burner, the gas is allowed to issue from a number of small holes at a very low pressure; and the current and quantity of the air are regulated by the use of the chimney. If the supply of air is not sufficient to combine with the quantity of gas issuing from the burner, the oxygen combines with the hydrogen and such of the carbon as it is equal to. In this case, the remaining particles of carbon leave the upper part of the flame in the form of smoke; and it is proved that all burners give their maximum amount of light relatively to the quantity of gas consumed when the flame is just on the point of smoking. With regard to flat-flame burners, he explained that the draught or inflow of air upon the flame depends greatly upon the velocity at which the gas issues from the burner—in fact, it is the chief regulator of the air supply. Every flame, by its heat, produces an upward current, which draws into its sides the surrounding atmosphere; and the greater the draught made by the flame, the more air is drawn into it—the result being that there is an excess of oxygen, which quickly destroys the solid particles of carbon in the gas, instead of allowing them, as in the Argand and proper burners, to remain in a state of suspension for a short time. Mr. West eulogized the labours of Mr. Sugg in connection with the improvement of burners. This gentleman had, he said, been the first to produce in this country an Argand burner constructed upon scientific principles. He had likewise greatly improved the batswing form; and had successfully introduced governors with flexible diaphragms to two burners used for domestic purposes.

Having briefly explained some of the laws and rules necessary to be observed in the economical consumption of gas, Mr. West proceeded to demonstrate, with apparatus which had been for the most part lent by Mr. Sugg, the difference between the old and defective burners and those of more modern construction. We give this part of the paper practically in full: On this meter we have burners attached; and by the observation of one minute, you can ascertain the quantity of gas they will consume per hour. We find that the consumption of a No. 5 fishtail burner, without any obstruction or regulator attached to it (so that any variation in the mains will affect it), ranges from 3 to 6·5 cubic feet per hour. It is now consuming at the rate of 5 cubic feet per hour, and gives a light only equal to about 12 sperm candles. If we increase the pressure, I can pass more gas through it without materially raising the illuminating power. These burners have holes pierced at the top at right angles. The streams of gas issuing through each of the orifices impinge one against the other and produce the shape of the flame. You will note that the interior of the flame is very blue compared with the batswing burner attached to the same meter, which flame is thicker and more brilliant, and is producing a light, with the same consumption of gas, equal to about 20 candles with the gas we are now using. In the one case the gas is driven boisterously upwards, and more air is drawn into it, which prevents the particles of carbon being sufficiently heated to develop the light it contains; while the gas issuing from the other burners is regulated so that those particles remain in suspension for a short time, until they get into a high state of incandescence, and hence the increase in the illuminating power.

We will next come to the regenerator kind of burners of Siemens, Sugg, Wenham, and others. In their arrangement, both the air and the gas are very highly heated before combustion; the result being that a better light can be obtained with from one-half to one-third the quantity of gas, according to the size and kind of burners used, than can be obtained from the ordinary burners. The small regenerator lamp I am using consumes about 3 cubic feet of gas per hour, and gives a light equal to 20 candles; and the larger lamps in the building give considerably more light per cubic foot of gas used than the smaller lamps. These burners with shades are used with great

advantage for private residences, if fixed near the ceiling, for the combined object of giving light and for ventilating.

We now come to that form of the incandescent method of gas lighting invented by Dr. Carl Auer von Welsbach. By this system, the gas-flame is utilized as a heating, instead of lighting, medium. The gas is supplied through a special form of atmospheric or Bunsen burner. The flame thus produced is non-illuminant; the object being to raise to a high state of incandescence the hood or mantle which is suspended over the flame, and which we are told is made from certain minerals found in the higher northern latitudes. The makers of these burners say that their most recent mantles for use with what they call their "C" size gas-burners give a light of from 18 to 20 candle power per cubic foot of gas consumed, and that they give this light for 1200 hours without diminution. They also claim that these "C" incandescent burners will give three times more light with half the gas than an Argand burner.

Having been asked especially to advise you as to the lighting of engineering workshops, I decided to make some experiments with these burners in one of our own turning and fitting shops. This shop is 142 feet long, with galleries all round, with a 10-ton travelling crane running from end to end. For lighting the shop, it is necessary that the burners should be above the top of the crane, which is 23 feet from the floor. Until recently, it was lighted with four gas-lights, with enamelled reflectors, having eight No. 5 burners in each, partially upon the regenerator principle; and these burners certainly lighted up the centre of the shop, so that we could see to handle things satisfactorily with the crane, but did not give sufficient light for erecting purposes. We then obtained some of the "C" incandescent gas-burners, and fitted six of them in a cluster as close as we could place them, and put over them reflectors 4 feet in diameter. We have three of these clusters, instead of four as formerly; and the light produced has been most gratifying. We can now do erecting in the centre of the shop without the aid of any other auxiliary lights. We have carefully tested both the old and new burners as to the quantity of gas consumed and the illuminating power; and I herewith append the results:—

Average Results of Several Experiments.

	Candles.
Illuminating power of gas as recently tested at Plymouth with the "London" standard Argand burner, consuming at the rate of 5 cubic feet per hour	15·86
No. 5 Bray's fishtail burners out of cluster of eight, when consuming at the rate of 5 cubic feet per hour, tested against the standard burner, gave an illuminating power of	12·18
"C" size Welsbach incandescent burner—	
Tested against the same standard burner, the incandescent burner, consuming at the rate of 3·2 cubic feet per hour, gave an illuminating power of . .	60·00
Incandescent burner corrected to standard of 5 cubic feet per hour would give an illuminating power of.	93·60

Comparison of Cost of Lighting.

	Candles.
With the old cluster of eight burners, the quantity of gas consumed per hour, when tested with a standard meter, was 33·47 cubic feet, which would give a total illuminating power of	81·53
With the new cluster of six "C" size incandescent burners, the quantity of gas consumed per hour, when tested with the same standard meter, was 18·65 cubic feet, which would give a total illuminating power of .	349·7
	Per Cent.
Saving in gas by the incandescent burner. . . . =	44·2
Increase in illuminating power by the incandescent burner . . . . . =	428·0

Old Cluster of Eight Burners.

Cost in pence for lighting for one hour (gas at 2s. 6d. per 1000 cubic feet)	1·0040
Cost in pence per candle per hour	0·0123
First cost of cluster of eight and reflector	£1 2 6

New Cluster of Six Incandescent Burners.

Cost in pence for lighting for one hour (gas at 2s. 6d. per 1000 cubic feet)	0·5600
Cost in pence per candle power per hour	0·0016
First cost of cluster of six and reflector	£4 12 2

From these figures, you will see that in future we shall only use about one-half the quantity of gas, and get more than four times the light.

The makers also claim for these incandescent burners that you can get the same light with them from 15 to 16 candle gas as you can from 20-candle gas; and I have some proof of this. This being the case, the question might be asked: Why make 20-candle power gas where 15-candle will answer the purpose? My reply to this will be that, when incandescent gas-burners become general, it will be wise for the Legislature to reduce the standard, and so enable gas companies and corporations to dispense with cannel and other enrichers, and sell gas at a cheaper rate to the consumers. This system of lighting is very much used on the Continent, and is to be seen in use at all the railway stations from the Dutch frontier to Berlin. It is also making rapid strides in London and other places, both for public and private lighting. We have 16 of the new burners in our drawing-office—being one to each draughtsman; and others in our general office. We find that the hygienic advantages are very great. By having suitable shades, you reflect a very soft and beautiful light upon the drawing-board; and I learn that our draughtsmen and clerks very much appreciate this new system of lighting.

The cost of this system of lighting is very small indeed when compared with electric lighting, as the following calculations will show:—

Incandescent Electric Lighting.

A 16-candle power lamp in use 1000 hours will absorb 60 units of electricity at 6d. per Board of Trade unit	30s. 0d.

Incandescent Gas Lighting.

An incandescent burner consuming 3 cubic feet of gas per hour, or 3000 cubic feet in 1000 hours, and giving a light equal to 60 candles, or fully three times that of the electric light, will cost—

With gas at Manchester, at 2s. 3d. per 1000 feet .	6s. 9d.
With gas at Maidstone, at 2s. 4d. „	7 0
With gas at Plymouth, at 1s. 9d. „	5 3

As to the arrangements for lighting public and private buildings, I advise that, in all cases of general lighting, you should hang or fix your chandeliers or pendants in the centre of the building or room, as a great amount of light is absorbed on the walls when brackets are used. In private houses, where the number of burners in use fluctuates very materially, I recommend the attachment of regulators to each burner; and these are now so numerous and cheap that they are within the reach of every consumer. For large works and factories, where, as a rule, the whole of the shops or rooms are lighted simultaneously, a large governor fixed at the outlet of the meter is an advantage; but where the workshops or rooms are very large, and at varying levels, it is advisable to have a governor fixed on each floor. By these means you can regulate the supply of gas to the burners to a very considerable extent. To make the light more perfect, however, it is necessary that you should use burners with checks inside them, or, what is far better, a small governor to each burner. When I first came to Manchester, fourteen years ago, the inferior types of burners without regulators were in use. By order of the Gas Committee, I tested a great number of them, when it was found that a large proportion were only giving half the light contained in the gas. From that time governors were introduced and universally employed; and we now find that in the large lamps, with the larger burners, we get more light than we obtained from the standard Argand burner. This is on account of burning it in large volumes, which assists in heating the air round the flame; and the particles of carbon are in consequence heated to a higher state of incandescence. I have been told that, since the introduction of high-power burners, Manchester has, taken as a whole, become the best-lighted city in Europe. For myself, I may say that I have not seen anything to surpass it.

In conclusion, I trust I have shown that the pecuniary and other advantages to be derived when gas is properly consumed are very great indeed. I hope that what I have laid before you may be of advantage to you individually, and that you will carry out the object of this Association by imparting to the community generally the information you have received; and then the writer of this paper will feel that he has been doubly repaid for the trouble he has taken.

In the course of the discussion on the paper,

Mr. H. Webb, referring to the statement that the illuminating power of gas varied from 12 to 20 candles, asked what would, in Mr. West's opinion, be the best candle power gas for the lighting requirements of a town. He said he understood that about 14-candle gas would be the most economical. He could speak with confidence as to the advantages of the Sugg burner for domestic lighting; but with reference to the incandescent light, his experience had been very unsatisfactory, especially with regard to the mantles, which he found did not last more than about four weeks. This was due, he thought, to the expansion and contraction of the mantles making them leave the rim of the Argand burner, so that air made its way in, and exercised an injurious effect.

Mr. Gendall said the incandescent light was equal to any for office work. He had tried it for upwards of twelve months.

Mr. J. Nasmith observed that, in his opinion, the problem as regards lighting was resolving itself into a question of getting some type of improved gas-burner, or, failing that, of the electric light. Although the incandescent burner was unmistakably a very powerful light, he thought there was no doubt that, like other brilliant lights, it had the faculty of leaving dark corners. He had also found, like Mr. Webb, a drawing away at the bottom of the burners, in incandescent lighting; and there was a considerable loss of power in the light after a few weeks' working. He had gone into the subject in connection with school lighting, and had come to the conclusion that what was wanted, if gas was to be adopted, was a system in which the light was not so much intense as diffused. They required a light that would carry. The incandescent burner might do for a drawing office, or other place where the light could be put just over the spot where it was needed; but for general purposes a more diffused light was required. He did not think gas managers would be wise to anchor themselves to the incandescent light. The need for improvement was, in his opinion, in the use of gas in other ways. With regard to the table given by Mr. West, he might point out that, though the first cost and the cost of burning per hour were given, the very large amount for maintenance had not been taken into account.

Mr. E. G. Constantine considered that the question of cost

would, after all, be the chief reason that deterred people from adopting the electric light, especially for domestic purposes. He said he would like some information from Mr. West as to his experience with the mantles of Welsbach burners. With regard to the diffusion of light, this, he should think, would depend very largely upon the form and material of the reflector.

Mr. J. SCHOFIELD observed that the incandescent light was not a thing that could be placed under the care of an ordinary workman or domestic servant, owing to the caution needed in putting on the chimney, and generally fitting up the arrangement. He should also object to the incandescent light on hygienic grounds. With regard to diffusion, he did not think the intense white light would penetrate to the same distance as an ordinary light.

Mr. J. SAYERS said he had had a number of incandescent lights in use since Christmas, and had not replaced a single mantle; in fact, he had never had any trouble with them.

Mr. DUFF had found the Welsbach light much more economical than the old burners.

Mr. A. SAXON remarked that one great hindrance to gas lighting was the want of cleanliness; and he should await with interest Mr. West's reply to the question as to the mantles in incandescent lights.

Mr. WEBB asked if Mr. West had experienced any inconvenience in connection with the incandescent light at his works, owing to the current of air caused by the crane travelling to and fro.

Mr. WEST, in replying upon the discussion, said with regard to the quality of the gas supplied to the public, there was considerable variation throughout the United Kingdom. In Scotland, they had a richer gas, owing to cannel being so near at hand; but they did not always know how to burn it properly. There were more smoky rooms in that country than in England. He himself thought gas of 15 or 16 candle power the best for commercial purposes. With respect to the incandescent light, he had not found any inconvenience on account of the travelling crane moving about. As to the mantles, he had only replaced four during the five months' working with the light. They had the Stott-Thorp burners in the shop previous to the introduction of the Welsbach burners. In the new arrangement, the reflectors were placed at such an angle that there were no shadows in the place. They had no pilot-lights in use in the shop referred to. There was certainly a great deal in the fixing of the mantles, as to their stability. As first made, they were very fragile; but they were now much stronger than formerly. With regard to the hygienic aspect of the question, the less gas they used for the same light, the fewer products of combustion there would be to make the atmosphere unhealthy. He thought it would be better to considerably reduce the standard of gas in Scotland, and also to lower it a candle or two in Manchester, providing the cost were reduced proportionately.

A vote of thanks was accorded to Mr. West for his paper.

A New Sewer for Paris.—A new sewer which has been constructed across Paris from Clichy to Asnières, has lately been formally dedicated to the public service. It is the first portion of an enormous enterprise which will take away the whole of the sewage of Paris from the waters of the Seine. The work was commenced in 1889; and it will require fourteen years or more to complete. The difficulties encountered, especially under the Seine proper, were many; and they took a long time to overcome. The river, forming its bed in remote times, upheaved the soil for a considerable depth. Crevices filled with alluvial matter, quicksands, calcareous rocks, conglomerates, and very hard silex were met within a few feet of each other. The machinery employed was the Beach hydraulic tunneling shield, an appliance now generally used for earthwork tunneling. As fast as the shield advanced, the huge iron rings forming the tube were adjusted. The length of the tunnel under the Seine is 1543 feet; its diameter, 8 ft. 6 in.

Water Companies and the Recent Frost.—The Secretary of the Kent Water Company (Mr. Alex. Dickson) has written to the Erith District Council, in reply to a letter from them complaining of insufficient water supply during the recent frost, expressing regret at the inconvenience and expense entailed upon the consumers, and stating that there has been no laxity on the part of the Company in endeavouring to cope with the difficulties which presented themselves. With regard to remedying the defects brought about by the intense frost, Mr. Dickson says considerable trouble is being experienced in obtaining competent pipe-layers and joint-makers; the services of this class of workmen being in great demand all over the country. He adds that the Company will, of course, restore the supply at the earliest possible moment; and during the summer the mains will be relaid at a greater depth, and everything done to obviate similar occurrences in the future. He asks that notice shall be given to the Company whenever the surface of existing roads is about to be lowered, or any new road formed, and the levels of the ground varied, thereby reducing the covering of earth above the pipes, in order that these may be properly protected. The Council are satisfied with the reply. The Secretary of the Lambeth Water Company (Mr. H. Wilkins) has also informed several Vestries that the Company are doing their best to repair their damaged mains. They have had 1000 extra men engaged on this work; but they require more skilled labour, and cannot obtain it in face of the present great demand.

REGISTER OF PATENTS.

Gas and Other Internal Combustion Engines.—Davy, D., of Parkhead, near Sheffield. No. 3485; Feb. 17, 1894.

This invention has in view the accomplishment of the same object as described in patents Nos. 3401 and 4696 of 1893—viz., "to effect economy by transforming into useful work a considerable portion of the heat of combustion which would otherwise be carried off by the water jacket."

This is done by compressing the explosive charge, and likewise a charge of pure air, in communicating chambers or spaces, so that part of the burning gases will mix with, and heat, the compressed-air charge, which thereby acquires an increased tension equivalent to the heat imparted to it, and acts conjointly with the burning gases in the explosion chamber, in performing work on the piston or pistons. The explosive charge, and the charge of compressed air, being prevented from mixing up to the moment of ignition, the richness of the former is not impaired, and the aggregate proportion of air to gas is claimed to be much greater than is possible in other engines.

In the engines described in the previous patents, the explosive and compressed-air charges were kept wholly separate during the compression stroke, and were put into communication at a given moment by the opening of a valve. The present improvements are designed to enable this valve and its operating mechanism to be dispensed with, and, notwithstanding that free communication is maintained between the two charges, to prevent them mixing during the compression stroke, by diffusion of the explosive charge into the compressed-air charge. To accomplish this, the spaces or chambers in which the two charges are respectively compressed are connected by a passage of relatively small area; and the admission and compression of the gas and air are so effected and controlled that, during the whole of the compression stroke, there shall be produced a sufficient rush of air through this neck from the compressed-air space to the explosion space to prevent any flow of gas or explosive mixture in the opposite direction—the quantity of air passing through the neck not being such as to excessively dilute the gas in the explosion chamber. When, as in the first patent of 1893, the gas or explosive charge is inhaled by a working piston, provision may be made to maintain the flow of air through the neck during the inhaling stroke as well as during the compression stroke. The ignition of the explosive charge is effected at a point near the neck or communicating passage; so that the combustion of the charge will proceed as it were backwards through the mass of the charge. In this way, only burning gases are projected into the compressed-air charge by the initial force of the explosion, which might otherwise cause part of the unignited charge to be projected into the air charge.

Coin-Freed Gas-Meters.—Thorp, T., of Whitefield, Lancs., Marsh, T. G., of Manchester, and Haynes, J., of Liverpool. No. 7899; April 21, 1894.

This prepayment mechanism for gas-meters is particularly applicable to the kind described in patent No. 23,924 of 1894; and it is designed to frustrate the "greased-penny" trick of fraudulent consumers. This is attained by arranging a lever operated by a cam, or a cam and spring, in such a manner that it ejects the coin from the coin-carrier during the forward movement of the latter, and lifts the lever into a position allowing the insertion of the coin during the return movement of the coin-carrier.

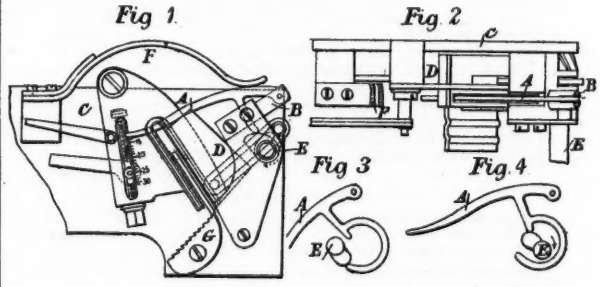


Fig. 1 is an elevation of the coin-carrier and parts for actuating it, with the coin-ejecting lever operated by a cam in conjunction with a spring. Fig. 2 is a plan. Figs. 3 and 4 show the ejecting-lever operated by a cam in two positions.

The lever A is fulcrumed in a stud B, screwed to a part of the frame plate C of the mechanism. The lever extends across the slot of the coin-carrier D, which is formed with a cross slot for the lever to work in. On the shaft E operating the coin-carrier is fixed a cam, which acts upon an arm formed on the lever A, and holds it up (as shown) when the coin-carrier D is in the position required for the insertion of a coin into the apparatus. When (after the insertion of a coin) the shaft E is turned in the direction of the arrow, the lever A slips off the cam, and is pushed down upon the coin by a spring F fixed upon a projecting part of the frame plate C, so that the coin is pushed down upon the serrated coin-race G, and is held down on it, and finally pushed off it, by the lever A as the coin-carrier is moved to the left. When the coin has been pushed off, and the shaft E is turned back in the opposite direction, to bring the coin-carrier into the coin-receiving position, the cam lifts the lever A again into its starting position at the top of the coin-slot.

Instead of using a spring, the descent of the lever may be effected by the lifting cam on the shaft E, as in figs. 3 and 4. The arm is in this case formed with a curved extension, reaching round and round in the shaft E. When the shaft is turned, as indicated by the arrow on fig. 4, the lever is first released, and afterwards pulled down into the position in fig. 3 by the back of the cam acting on the curved part. To facilitate the pushing off of waxed or smeared coins, the sides of the coin-slot are corrugated as shown.

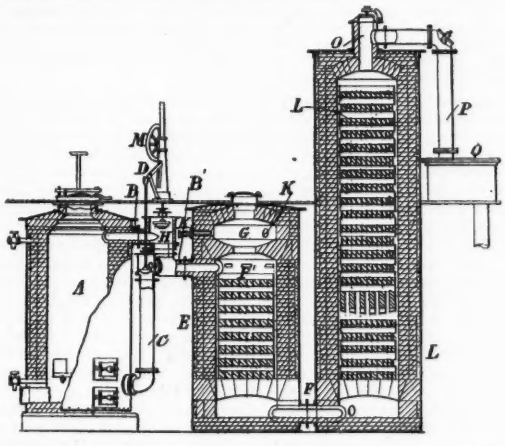
Combined Gas-Lamp and Sewer-Gas Extractor and Destructor.—Webb, J. E., of Hockley, Birmingham. No. 8193; April 25, 1894.

This invention is designed to obviate one of the difficulties sometimes experienced with gas-lamps used as sewer-gas destroyers—viz., that a sudden flushing of the sewer may prevent any sewer gas from escaping, and thus momentarily cause the gas-jets to be extinguished.

It is proposed to provide a lamp-head connected by a pipe with the sewer, and practically sealed at all other points except at the discharge opening. Within the lamp-head are a series of flat-flame or other burners supplied from the gas-main in the usual manner. A bye-pass with a jet burner is also provided; and the air to support the combustion of this particular jet is obtained by a small pipe passing through the casing into the air.

Water-Gas Apparatus.—Guldlin, O. N., of Fort Wayne, Ind., U.S.A. No. 23,454; Dec. 3, 1894.

This invention claims "the combination with a water-gas generator, of a carburetting and fixing chamber, having a separate oil-vaporizing chamber at the top, free from checker-brick, and provided with a lateral oil atomizing or spraying device and a solid annular floor or hearth, having a central opening communicating with the fixing chamber below, a combustion chamber below the vaporizing chamber and above the fixing chamber, a pipe for the gas leading from the generator, and a separate air inlet-pipe—both connecting with the combustion chamber, whereby the atomizing device will be protected from excessive heat, and whereby the oil vapour or gas passing down through the central opening will be enveloped by the current of inflowing water gas, and intimately mixed therewith, thereby preventing the hydrocarbon vapours from being destructively decomposed by the excessive heat of the brickwork."



The gas-generating furnace A is of the usual construction. It is provided at top and bottom with steam supply-pipes, and with an air-pipe connecting with the ash-pit. The gas escape-pipes B C, connecting respectively at the top and bottom of the generator, are provided with valve boxes or chambers leading to the combustion chamber in the carburetting and fixing chamber E. The upper cylindrical valve chamber is connected between the eduction-pipe B and the delivery-pipe B^1, and is preferably provided with an annular hollow valve seat for a conical or hemispherical valve. The lower gas eduction-pipe C is provided with a cylindrical valve chamber, having a suitable valve-seat and a valve; and the valve chamber connects by a short pipe with the delivery-pipe to the fixing chamber. The valves are connected with a lever D, joined by a shaft with the hand-wheel M, for raising and lowering the valves—the construction being such that, when one valve is lowered upon its seat, the other valve will be raised, so as to always ensure a free passage for gas through one of the eduction-pipes to the carburetting and fixing chamber.

This carburetting and fixing chamber E is constructed with an open brickwork arch near its bottom, and serves to support some brick checkerwork above it. The chamber is provided near the top with a brick arch or partition, forming an inclined annular hearth or floor for the upper vaporizing and heating chamber G, and containing a central opening. The upper surfaces of the bricks forming the partition are inclined downward from the sides of the chamber toward the central opening, for conducting any oil which may be admitted to the chamber G, down to the central opening, and thence on to the checker-brick below. A combustion chamber F^1 is formed between the checker-brick and the partition, and is provided in its side walls with air-ports and the gas inlet-pipe. The chamber is provided at the top with a central vertical opening or passage, which, in practice, is closed by a tile and a tight-fitting lid.

The oil supply-pipes or injectors K are placed horizontally in the walls of the chamber G. They are arranged tangentially, or at an angle to the circumferential wall, so as to give to the jet of oil a whirling motion in the chamber. With this construction, the oil spray will circulate around in the chamber, and become heated and vaporized or gasified, after which it will flow down through the central opening into the chamber F^1, and be there enveloped and absorbed by the water gas flowing in.

The bottom chamber of the carburettor E is connected by a pipe F with the bottom chamber of the usual superheater or fixing chamber L. The superheater is provided with the ordinary open brick arch near the bottom, supporting some checker-brick above; and it is provided at the top with a short smoke stack O, having a tight-fitting lid. The gas take-off pipe P connects with the stack, and extends down into the water-seal chamber Q. An air supply-pipe connects through the ports with the combustion chamber at the top of the chamber E, and a second air supply-pipe with the chamber at the base of the fixing chamber L.

The operation of the plant is as follows: A fire is kindled on the grate; and it is fed with hard coal or coke until a deep body is heated to incandescence. So soon as combustible producer gas is given off from the bed of fuel, the gas is passed through pipes B and B^1 into the chamber F^1, where it is burned by jets of air admitted through the ports shown, and the products are passed down through the checker-bricks, and thence through the pipe F, into the bottom chamber of the superheater or fixing chamber L, and finally escape through the stack O, the lid of which is open. The oil vaporizing and heating chamber G is heated by radiant heat from the combustion chamber F^1 below, and is heated to a sufficient degree to properly vaporize and partially gasify the hydrocarbon oil without destructively decomposing it. The body of fuel having been heated to incandescence, and the two chambers containing checker-brick having been heated to the desired temperature, the air blasts are shut off; the lid at the top of the superheater is closed; and water gas is generated by admitting steam, either at the top or bottom of the generator. The resulting water gas is passed off through one of the eduction-pipes B or C and the delivery-pipe B^1, into the chamber F^1 of the carburettor and fixing chamber E. At the same time, oil is forced (under pressure) through the injectors K, and discharged in a fine mist in the vaporizing and heating chamber G, in which vaporization and partial gasification are effected. The oil vapour or gas passes, in a comparatively slow current, down through the large central opening between G and F^1, and is immediately enveloped in, and absorbed by, the entering water gas, which prevents it from being destructively decomposed. About a minute before steam is shut off from the generator, or before the run is finished, the valve in the oil supply-pipe is closed. Then the water gas rises through the central opening in E into the vaporizing chamber G, and absorbs the remaining oil vapour, so that all of it is utilized.

APPLICATIONS FOR LETTERS PATENT.

5092.—Lochtie, T. D., "Water-escape alarm." March 11.
5099.—Kass, F. M., "Electric gas lighter." March 11.
5111.—Stevens, G., "Indicating and localizing stoppages by frost in water-pipes, to prevent pipes from bursting." March 11.
5113.—Holmes, P. F., "Washing gases." March 11.
5155.—Bickerton, H. N., "Gas-engines." March 12.
5159.—Maclaren, J. F., "Internal combustion engines." March 12.
5186.—Sprague, H. H., "Gas-meters." March 12.
5213.—Violet, R., "Burners for incandescent gas-lights." March 12.
5260.—Redish, A. H., "Street stand-pipes." March 12.
5268.—Hour, C., "Gas-meters." March 12.
5311.—Upward, A. R., "Incandescence lamps." March 13.
5337.—Hirsch, E. F. W., "Chimneys for incandescent gas-lamps." March 13.
5351.—Fitzsimmons, A., "Lighting railway carriages and other vehicles." March 13.
5410.—Kingdon, J. A., "Protecting electrical conductors, water-pipes, &c." March 14.
5422.—Pringle, R., "Gas-stoves." March 14.
5443.—Bryan, J., "Gas-engines." March 14.
5449.—Wright, W., and Reed, F. J. P., "Draught protector for incandescent lights." March 15.
5452.—Beechey, C. G., "Coin-freed gas-meters and other analogous coin-freed apparatus." March 15.
5463.—Clayton, R., and Jaques, W. E., "Deflector grilling-plates for gas cookers, grillers, &c." March 15.
5475.—Stewart and Clydesdale, Ltd., and Wotherspoon, J., "Jointing metallic pipes or tubes." March 15.
5476.—Spiel, E., and Bruckner, W., "Lamps for burning gas, petroleum, or other liquid hydrocarbons." March 15.
5490.—Hegetschwyler, R., "Combined gas lighter and tap, cock, or valve." March 15.
5494.—Catterson and Sons, Ltd., and Catterson, W. P., "Ovens for use with oil or gas stoves." March 15.
5497.—Mark, J., "Water-pipes." March 15.
5500.—Lucchesini, A., "Increasing the illuminating power of incandescent lamps." March 15.
5508.—Jamieson, J. L. A., "Pipe-joints." March 15.
5509.—Marcus, S., "Incandescence lamp for liquid hydrocarbons." March 15.
5510.—Marcus, S., "A lamp operating by the vaporization and combustion of liquid hydrocarbons, more particularly for incandescence burners." March 15.
5519.—Seymour, W., "Preventing the bursting of pipes in frosty weather." March 15.
5529.—Lake, H. H., "Producing and liquefying acetylene gas." A communication from E. N. Dickerson and J. J. Suckert. March 15.
5530.—George, F., "Preventing the overflow of water from fractured water-pipes, and ascertaining the position of the fractures." March 15.
5683.—Dougill, A., and Marks, J., "Governing and regulating gas-engines, and easing the compression on the back stroke." March 19.
5686.—Winfields, Ltd., and Abbott, A., "Centre-light suspending arrangements." March 19.
5710.—M'Grath, D., C., and P., "Detachable pipe connector adaptable to all sorts and sizes of gas, steam, and water pipes." March 19.
5730.—Lake, H. H., "Producing and liquefying acetylene gas." A communication from E. N. Dickerson and J. J. Suckert. March 19.
5732.—Thompson, W. P., "Manufacture of oil from gas." A communication from G. D. Bayaud, G. F. Perrenoud, and G. H. Harvey. March 19.
5848.—Griffin, F., "Movable gas-brackets." March 20.
5866.—Loisel, L. J. M., "Igniting devices for gas and petroleum engines." March 20.
5931.—Curtis, H. P., "Water-supply pipes and the like." March 21.
6015.—Darby, W. and I., "Oil or gas stoves for cooking and heating purposes, and utensil for use therewith." March 22.
6027.—Rowan, T., "Economical use of gas for lighting purposes." March 22.
6029.—Paccaud, E., and Coppet, F. de, "Liquid-meters." March 22.
6032.—Dodwell, W., "Stop-taps for the prevention of pipe-bursting." March 23.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Threatened Litigation respecting the Oxy-Oil Gas Patents.

SIR,—My attention has been called to a paragraph, under the above heading, which appeared in your last issue; and, for the information of your readers, permit me to say that the matter referred to at the last meeting of the Huddersfield Town Council had reference to patent No. 14,490 of 1892, in the name of Benjamin Parkin, of Golcar, near Huddersfield, particulars of which may be obtained by referring to your "Patent Register" of about that date.*

My Company received a letter, dated Feb. 12, 1895, from Messrs. Dodson and Co., Solicitors, Halifax, alleging infringement; and, after obtaining technical advice on the matter on behalf of my Company, I wrote in reply, disclaiming any such thing.

I may say that either the Huddersfield Corporation or anybody using our patents, under licence from us, are indemnified against any legal proceedings or claims arising from such actions. Therefore, under the circumstances, no one need fear such contingencies, or hesitate to utilize such a valuable enricher as the oxy-oil gas process has proved itself to be.

JOHN ED. GRESTY, Secretary,
Northern Counties Hydro-Oxygen Gas Company, Limited.

Huddersfield, March 29, 1895.

Removing Carbon from Gas-Retorts.

SIR,—In reply to Mr. Gibb's letter of March 21, I have had a few months' experience with Good and Spencer's apparatus for removing carbon from gas-retorts. It is a very cheap and simple method. I was rather sceptical at first as to removing the carbon so quickly as the makers describe it; nor have we been quite so fortunate at present. Yet it does its work well and quickly. There is no danger to the retort from the water dashing on to the carbon. It causes a blackness; but it is only superficial, and gains its usual colour in a very short time, with no perceptible damage to the retorts. Our method is to slack two retorts at 9 a.m.; and after the stokers have done their draw, the retorts are cleaned—taking about 40 minutes each. Before 12 noon we put in a small tar charge; and at 3 p.m. we put in the ordinary charge. Thus each retort is doing its usual work after six hours. It employs two men to do the work.

THOS. E. SHADBOLT.

Grays, March 30, 1895.

SIR,—I used Good and Spencer's method for removing carbon from retorts during last winter, and can remove the carbon from a retort in ten minutes that would take days to remove if the retort stood off empty. I do not think the water hurts the retorts nearly so much as letting them stand off empty.

JAMES E. ROPER.

Berkhamsted, March 30, 1895.

Shilling Prepayment Meters.

Referring to the paragraph under the above heading in the JOURNAL last week (p. 646), we may mention that, in addition to the firms therein named as makers of shilling prepayment meters, these meters are manufactured by Messrs. George Orme and Co. and Messrs. Thomas Glover and Co.

Stockport and the Gas Supply of Heaton Norris.—At the last meeting of the Heaton Norris District Council, a deputation reported the result of an interview they had had with the Gas Committee of the Stockport Corporation regarding the price and quality of the gas supplied in the district. Respecting the quality, the Committee informed the deputation that they had received few complaints during the last six months, and the illuminating power had always been equal to 18 or 19 candles. They promised to recommend the Corporation to sanction an all-round reduction of 2d. per 1000 cubic feet from next quarter day; but as to the public lamps, they would only be prepared to come to some reduction if the District Council were willing to light and repair their own lamps. In reference to the differential rate of 6d. per 1000 cubic feet, this, it was stated, was charged to all the out-districts, and Heaton Norris was no exception to the rule.

The Price and Quality of Gas at Ossett and Horbury.—A conference of representatives of public bodies at Ossett and Horbury was held on Monday last week, to consider the question of the gas supply. Among the various speakers was Mr. W. Taylor, of the Ossett Tradesmen's Association, who observed that formerly the gas was sold at 2s. 6d. per 1000 cubic feet; and he questioned whether coal was any dearer now that they were charged 3s. He suggested that the increase of price was due to the action of the Company in calling up the remainder of their capital at 7 per cent. instead of using their borrowing powers. The only way of remedying the existing evil was for the Local Authorities to purchase the gas undertaking. Even if taken compulsorily, at a cost of £100,000, he believed that the profits of the concern would be sufficient to produce a surplus to relieve the rates. He therefore strongly advocated the municipalization of the gas-works. Mr. W. France urged that the Local Authorities should take decided action; but he was opposed to putting £100,000 into the pockets of the shareholders. The Mayor of Ossett (Alderman G. H. Wilson) and Messrs. J. Wilson and H. Smith addressed the meeting. It was stated that in one portion of the borough the Corporation had for years been lighting the road with oil-lamps, because the Company refused to lay a main to supply gas. It was also said the question of electric lighting would shortly be brought before the authorities of both townships. A resolution was unanimously passed that requisitions be handed to the Mayor of Ossett and the Chairman of the Horbury District Council, asking them to call town's meetings to protest against the price and quality of the gas. A Committee was also formed, with a view to other steps being taken.

* See JOURNAL, Vol. LXII., p. 131.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bill brought from the Commons and read the first time: Newmarket Gas Bill.

Bills read the third time and passed: Ambleside Urban District Council Gas and Water Bill, Felixstowe and Walton Water Bill, Hebden Bridge and Mytholmroyd Gas Board Bill.

HOUSE OF COMMONS.

Wednesday, March 27.

SOUTH METROPOLITAN GAS BILL.

Mr. MUNDELLA moved the following instruction to the Select Committee on this Bill:—

That it be an instruction to the Committee on the Bill that they have power, if they think fit, to insert the following clause: "Subject to the regulations set forth in the first schedule to this Act, the Directors of the Company may, at such times as they deem expedient, prepare a scheme for the purpose of enabling persons in the employ of the Company, and holding ordinary stock, to elect a representative or representatives to take part with the Directors in the management of the Company, and may submit the scheme to a special general meeting of the Company duly called, with notice of the business to be considered thereat, and the meeting may adopt the scheme, either without alteration or with such alterations (not being inconsistent with the said regulations) as the Directors may assent to; and the scheme so adopted shall be submitted for the approval of the Board of Trade, and that Board may consider the same, and may either approve the same without alteration, or may suggest any alterations therein not being inconsistent with the said regulations; and if the Directors assent to the alterations (if any) so suggested, the Board of Trade may approve the scheme as altered. That the scheme, when approved, be published in the *London Gazette*, and from the date of such publication have, during the period prescribed in the scheme full force and effect."

He said that the Royal Commission on Labour reported that it had had evidence from various sources with respect to the advantage of profit-sharing; and an admirable appendix on the subject was attached to the report by Mr. George Livesey, the Chairman of the South Metropolitan Gas Company, respecting whose Bill he (Mr. Mundella) was now proposing to move this instruction. After setting forth the advantage of profit-sharing generally in industrial undertakings, Mr. Livesey said: "An entirely different application of the principle of profit-sharing is necessary in such cases as gas companies, where the profits are always strictly limited by Parliament. In many instances, it is in proportion to the prices charged for gas under what is known as the sliding-scale. When additional profit can be earned, no portion can be divided until the greater part has been absorbed by reducing the price of gas, when the shareholders thereby became entitled to an increased dividend not exceeding one-quarter or 5s. per cent. for each 1d. reduction. Parliament thus made the consumers and the shareholders partners; it being to the interest of both that gas should be sold at as low a price as possible. But it has quite overlooked the interests of the employed, to whom apparently no thought has been given. All, however, that is necessary is to include them in the partnership by providing that a certain percentage of their salaries and wages shall be paid for every reduction of 1d. per 1000 cubic feet, and taking that percentage off when the price of gas rises. The interests of the consumers, the shareholders, and the officials and workmen can thus be rendered identical, which is the aim and essence of profit-sharing. It is a question whether Parliament should not require the inclusion of the employed in the partnership under the sliding-scale of the gas companies; thus doing justice to all parties." He would not have moved this instruction if it imposed any obligation whatever upon the Company. It was an entirely new departure. But the South Metropolitan Gas Company had adopted the system of profit-sharing, and had done so with great advantage; and when they proposed to go to Parliament with their Bill this year, the Chairman prepared a clause which would carry out the principles he had laid down in his capacity as a member of the Royal Commission on Labour. The clause which he (Mr. Mundella) had to move as an instruction to the Committee was Mr. Livesey's own clause. On the 13th of February, at the annual meeting of the Company, Mr. Livesey explained to the shareholders that he was in favour of this clause, and that he would be glad to see its inclusion in the Company's Bill. He was simply defeated by a majority of one on the Board of Directors. As the clause did not impose any obligation on the Company, and was merely a permissive and enabling clause, and permitted them (if and when they thought fit) to apply for a scheme to carry out the principles of profit-sharing, and to include the capitalist and the workmen not only in sharing the profits but in the management and direction of the undertaking, he (Mr. Mundella) thought it right that he should bring the clause before the House, and ask that it might be made an instruction to the Committee that they should, if they deemed it right, include it in the Bill. The Select Committee to whom the Bill had been referred sat on the previous day, and Mr. Livesey brought the clause before them; and it would be a satisfaction to him, and to several of his co-Directors, if it were included in the Bill. It was, as he had said, no new departure in the sense of imposing an obligation upon any gas company or other industrial company; but it enabled them, if they thought fit, without again applying to Parliament for an Act, to adopt the scheme of profit-sharing of which Mr. Livesey was the advocate, which would have the very best possible results if put into operation. He (Mr. Mundella) should be very glad to see the South Metropolitan Gas Company doing this in the interests of the public, as well as in those of peace and goodwill between employers and employed, which would be promoted if the Company adopted the system Mr. Livesey proposed.

Mr. BRYCE said perhaps, with the indulgence of the House, he might make a suggestion before the clause was put. He thought it would be desirable for the instruction to the Committee to be more "elastic." His right hon. friend (Mr. Mundella) had put it in the form of a

particular clause, which bound the Committee to adopt it as it stood on the paper. Would it not be better if the substance were put, and the Committee allowed to make such amendment, subject to the retention of the substance, as would enable the clause to be more effective? He would therefore suggest that his right hon. friend should not move the instruction as put on the paper, but in this form: Instead of the words "insert the following clause," let it read "insert a clause" to that effect. In this way the substance would be retained, and the hands of the Committee would not be tied.

Mr. MUNDELLA said he would be happy to adopt the suggestion. He only put the clause on the paper in its present shape because it was the clause of the Company, and was prepared by their draftsman and suggested by their Chairman.

The SPEAKER said he would put the instruction to the House in that form.

Sir MICHAEL HICKS-BEACH said he entirely agreed with the spirit which dictated the proposal. When serving on the Labour Commission, they had heard a good deal of this matter; and he thought nobody who had considered it at all, and who was satisfied, as he was thoroughly satisfied, that it was to the advantage of one of these Companies that those who worked for the Company should have an interest as shareholders in the concern, would not also agree that some provision, although even of a tentative character, for the representation of the workmen upon the board of directors, was a matter which certainly ought to be considered. A Company who, like the South Metropolitan Gas Company, were ready, as he believed, to take the initiative in framing and carrying out some scheme for the purpose, really deserved well of all those who desired to promote good social relations between employers and employed. He would make one suggestion. He was very glad to hear the President of the Board of Trade (Mr. Bryce) raise the objection that the proposal of Mr. Mundella might be, to some extent, too narrow, and fetter the discretion of the Committee. He was not quite sure that, even as it had been put from the chair, some objection of that kind could not be taken. He hoped they might understand that, as now worded, it really did leave the hands of the Committee open to insert whatever provision upon that particular subject might be proposed by those who were interested therein, to consider those provisions, and to amend them, if necessary, in any way. He did not know if this was so; but he hoped the Committee would really have a free hand in the matter.

Mr. MUNDELLA: Hear, hear.

Mr. BRYCE said he was very glad that Mr. Mundella approved of this course, and that Sir Michael Hicks-Beach coincided with it, and desired to see the object carried out. He thought it was one which commended itself to every part of the House; and they were very pleased indeed that it might be taken advantage of, and might carry out the wishes of the right hon. gentleman, and give schemes of profit-sharing a fair chance by coupling with them a certain share of the management of the concern. There was nothing, he thought, more desirable than that an experiment in this direction should have a proper chance; and therefore he very heartily supported Mr. Mundella's proposal. With regard to the question put by Sir Michael Hicks-Beach, he understood—and this was a matter on which he might perhaps venture to ask for the Speaker's ruling—that the clause, in the form in which it had then been moved, would be one which would leave the hands of the Committee free, for the reason that they were to insert "a clause." He thought the words "a clause" sufficient to show that it was not to be this particular clause in those particular words, but a clause to that substantive effect; and he would ask the Speaker to be good enough to offer an expression of opinion on that point.

The SPEAKER said he did not know that he was better qualified to interpret the words than the right hon. gentleman or the House. As he understood it, the object of the amendment was to give the Committee greater latitude—(Mr. MUNDELLA: Hear, hear)—if they thought fit, to insert words to carry out the effect of the clause, without binding them to its actual phraseology. There might be a clause or clauses in which they would embody their wishes.

Mr. MUNDELLA thought it would be desirable to add the words "or clauses." This would give even more elasticity to the instruction.

The SPEAKER: I will put it to the House in that shape. The question is—

That it be an instruction to the Committee on the Bill that they have power, if they think fit, to insert a clause or clauses to provide that, subject to the regulations set forth in the first schedule to this Act, the Directors of the Company may, at such times as they deem expedient, prepare a scheme for the purpose of enabling persons in the employ of the Company, and holding ordinary stock, to elect a representative or representatives to take part with the Directors in the management of the Company, and may submit the scheme to a special general meeting of the Company duly called, with notice of the business to be considered thereat, and the meeting may adopt the scheme, either without alteration or with such alterations (not being inconsistent with the said regulations) as the Directors may assent to; and the scheme so adopted shall be submitted for the approval of the Board of Trade, and that Board may consider the same, and may either approve the same without alteration, or may suggest any alterations therein not being inconsistent with the said regulations; and if the Directors assent to the alterations (if any) so suggested, the Board of Trade may approve the scheme as altered. That the scheme, when approved, be published in the *London Gazette*, and from the date of such publication have, during the period prescribed in the scheme, full force and effect.

Sir MICHAEL HICKS-BEACH said that if he might make a suggestion, it would be that they would leave out in the proposal all the words after "the management of the Company." If Mr. Bryce would look at that, he would see that what the instruction would amount to then would merely be an expression of opinion that the Committee might usefully follow the principle of this proposal; leaving it to them to carry out the details in whatever way they might think proper. He did not know if he would be in order in moving the omission of these words so as to raise the point.

Mr. BRYCE said the only difficulty he felt was that this was a clause which had been already considered by the Company, and he was not quite certain that any large change in the wording of it would be capable of carrying the same amount of assent; otherwise he did not see any objection. This was rather a matter for those who knew what were the views of the draftsman of the Company.

Sir MICHAEL HICKS-BEACH said he should be inclined to adopt whatever view the President of the Board of Trade took on the matter.

Mr. MUNDELLA said that, with regard to the amendment of the right hon. gentleman (Sir Michael Hicks-Beach), he quite agreed that it would afford still greater scope to the Committee in their consideration; but the clause had received the assent of a number of the Directors and shareholders, and he thought the indication that the Board of Trade should be consulted about it would be of advantage. He hoped, therefore, that his right hon. friend would not persist in his amendment.

Sir MICHAEL HICKS-BEACH said, after what his right hon. friend had stated, he would not press it.

The instruction was then agreed to.

Thursday, March 28.

WATER SUPPLY TO FIRE-PLUGS.

Mr. A. C. MORTON asked the President of the Local Government Board whether his attention had been drawn to the provisions of the Water-Works Clauses Act, 1847, which impose on water companies the duty of keeping charged with water at all times (except when prevented by frost) all their pipes to which fire-plugs are attached; whether he had any power to enforce compliance with this enactment by the Water Companies; and, if so, whether he would at once take steps to secure that their pipes should be kept properly charged with water for the purpose of extinguishing fire.

Mr. SHAW-LEFEVRE said he was aware of the provisions referred to in the Act of 1847; but he had no power to enforce compliance by the Companies with those provisions. It appeared that the only remedy was by way of *mandamus;* but who was to apply for it, he was not in a position to say.

Mr. MORTON: Is not the Department of the right hon. gentleman the authority to deal with questions of this kind?

Mr. SHAW LEFEVRE; No; that is not so. If anybody is the authority, it is the local authority; but the Act does not say who is the authority to enforce its provisions.

The following progress was made with Bills last week:—

Bills read the first time: Ambleside Urban District Council Gas and Water Bill, Felixstowe and Walton Water Bill, Hebden Bridge and Mytholmroyd Gas Board Bill.

Bills reported: British Gaslight Company (Staffordshire Potteries) Bill, Brymbo Water Bill, Whitby Water Bill, York New Water Bill.

Bill read the third time and passed: Newmarket Gas Bill.

HOUSE OF COMMONS COMMITTEE.

Tuesday, March 26.

(*Before Mr.* A. DE TATTON-EGERTON, *Chairman; Mr.* AINSWORTH, *Mr* TOLLEMACHE, *and Mr.* DALZIEL.)

SOUTH METROPOLITAN GAS BILL.

This Bill, which is to provide for the conversion of the authorized capital of the Company, with a standard dividend of 10 per cent., into capital having a uniform standard rate of dividend of 5 per cent., and for other purposes, came under consideration to-day.

Mr. POPE, Q.C., Mr. CRIPPS, Q.C., and the Hon. ALFRED LYTTELTON appeared for the promoters; Mr. WORSLEY TAYLOR, Q.C., and Mr. FREEMAN, for the London County Council, who opposed the Bill. A formal appearance was also entered against the Bill by the Lambeth Vestry; but they were unrepresented by Counsel.

Mr. POPE, in opening the case, said the Bill was of a purely domestic character; and, unless it were from some misapprehension in regard to it, or some feeling that they ought to be heard in everything which pertained to gas and water, he really did not know what the London County Council could have to say in the matter. It might be a question as to whether the shareholders of the Company, if they could show that injury would be done to them, or the consumers of gas, might reasonably be heard; but, in something which was so purely domestic, he did not think he should have much trouble in dealing with the question. The main purpose of the Bill was to convert the existing capital of the Company (which consisted of various stocks, bearing a dividend of at least 10 per cent., but subject since 1876 to the auction clauses and a sliding-scale) into 5 per cent. stock of double the amount—distributing the shares entitled to half the amount of dividend among the holders of the 10 per cent. shares, in proportion to their holding. Practically it was found that, with a high dividend, and therefore a high-priced share, the actual value of the share was not realized in the interest of the consumer and the shareholder, as well as of the public generally, as readily as when it was a more reasonable amount so to speak. The effect of a 10 per cent. dividend and the sliding-scale with regard to the stock of the Company was that some of the ordinary stock was worth as much as £309; and the "B" stock was worth as much as £297. Of course, this £297 was paid by the public for £100 of stock, and it entitled them to the 10 per cent. dividend, and to the operation of the sliding-scale; so that, in reality, the holder paid £197 extra for the purpose of securing the extra dividend. It was found, in practice, that a 5 per cent. stock commanded proportionately a higher price than the 10 per cent. stock. Since Mr. Forster's Committee inquired into the question of the Metropolitan Gas Supply in 1875, there had been introduced, according to a common form settled by Parliament, what were known as the auction clauses, and also a sliding-scale applicable to all gas capital. The effect of the auction clauses was that, when Parliament authorized the raising of a certian amount of capital, it put upon the companies the obligation not to distribute the capital, as used formerly to be done, among their shareholders at par, so as to entitle them to get a premium by reason of the good management of the undertaking, but obliged them to submit it to auction, so as to obtain the biggest price. All the future capital of the Company would be, and a great proportion of the past capital had been, subject

to the auction clauses; and one of the objects of the Bill, in converting it all into a 5 per cent. capital, was at the same time to make it consistent with the provisions of the sliding-scale, the principle of which was practically to make the consumers partners with the shareholders in the profit earned. It would be admitted, by everybody who knew anything about the subject, that the South Metropolitan Company was exceptionally well managed. From its very inception, the capital account had been reasonably kept down; and the economy of management had been remarkable—so much so, indeed, that the Company had been able to reduce the price of gas from the statutory amount of 3s. 6d. to 2s. 4d. per 1000 cubic feet. This gave a certain number of pennies in respect of which there was a certain division of profit—the consumer getting the reduction of the penny in price, and the shareholder obtaining the right, by reason of that reduction, to a higher amount of dividend, if it could be earned, than the statutory 10 per cent. dividend. The profit divided in the case of the "B" stock had been 12 per cent. upon the nominal amount of the stock which appeared in the books of the Company as issued under the authority of Parliament. The various stocks which it was now proposed to convert into one stock of one denomination were: "A" stock, £500,000; "B" stock, £1,350,000; and "C" stock, £362,500. In connection with the last-named stock, it was proposed to authorize such a further amount of stock as, with the premiums added, would produce £600,000, to be employed in the business of the Company. The principle involved in this Bill had already been sanctioned by Parliament in several other cases, notably in those of the Crystal Palace District Gas Company and the Bristol Gas Company. Mr. George Livesey, the Chairman of the South Metropolitan Company, who was practically the author of all good things in the way of gas manufacture and the regulation of gas companies, was responsible for the suggestion which was adopted in the Crystal Palace Company's case, which was followed in the Bristol Company's case, and which was now sought to be adopted in that of the South Metropolitan Company. He (Mr. Livesey) would be called as a witness; and no doubt he would be able to explain satisfactorily to the Committee that the proposal could be carried out not only without disadvantage to the public, but so as to secure that, at the auction of the capital, the best possible price would be obtained for the stock. This was in the interest of the public, because the larger the premium obtained for the stock, the greater the amount which practically did not receive any share in the 10 per cent. dividend. Then there were in the Bill some subsidiary proposals, one of which was that, where stock was held in small amounts by the workpeople in the employ of the Company, they should, without the necessity of going to the expense of a transfer, nominate to whom the stock should pass. The object of another clause was to enable the Company to offer to gas consumers and to their employees the new stock sold at the price which it commanded in the market in the previous week. The only distinction between this and what could be done now was that, according to the existing law, the Company must first advertise an offer by auction, and then whatever stock was left over could be offered to the gas consumers at that price. What was now proposed was simply that the Company should have the right to do this before putting the stock up to auction, so as to be quite sure that, if the public would take it at the market price, it would realize that price. Turning to the petition of the London County Council, they alleged, amongst other things, that the effect of the proposed alteration, while conferring no benefit upon the public or upon the consumers of gas, would cause it to appear that, instead of paying dividends at the rate of 13 per cent, the Company were only paying at the rate of 6½ per cent. He had endeavoured to show that this would be a benefit to the consumer and to the public. While the Company were really paying 13 per cent. upon the nominal stock, they were really only paying 6½ per cent. upon the actual capital invested in the undertaking; and therefore, in truth, it would be clearer to those who desired to know what the profit of the Company was. The County Council further submitted that additional capital powers should not be conferred upon the Company. It was not a question of more capital; it was purely the conversion of capital already existing. The petitioners also urged that, in the event of further powers and concessions being conferred upon the Company, provision should be made for a reduction in the standard price to be charged for gas, and that, instead of issuing additional share and loan capital under the present conditions, the Company should be placed under obligation to raise, by the creation and issue of debenture stock bearing a lower rate of interest, such further money as might be required. In other words, the County Council asked the Committee to do what Parliament had hitherto absolutely and uniformly refused to do—viz., to revolutionize the entire system of gas finance which was settled in 1876. The Council must have introduced that paragraph rather with the view of making a sort of parliamentary protest, and of keeping the question alive, than with any expectation that it would be productive. The Council also suggested that the Company should be placed under further obligations with respect to the quality and illuminating power, and also the testing of their gas. He really did not understand why. If he had not had the opportunity of reading two or three County Council speeches delivered on the second reading of the Bill, he would have been at a loss to understand what really was the misconception of the Council. There appeared to be a considerable misapprehension and talk about "watering capital" and other Stock Exchange phrases. But in the case before the Committee, there was no watering or "gerrymandering" of capital. It was a most straightforward measure; and the subordinate provisions were introduced with the view of carrying out, as far as possible, the principle which had actuated the Company from the commencement—viz., interesting the gas consumers and the persons in the employ of the Company in the prosperity of the undertaking itself. As the Committee were, no doubt, aware, Mr. Livesey was the author of a profit-sharing scheme with his own workpeople; and the result of thus interesting them in the economy of working had been to promote settled and harmonious relations between the Board and the employees which had justified to the fullest extent all that had been done in this direction.

Mr. *George Livesey*, examined by the Hon. A. LYTTELTON, having explained the working of the sliding-scale and the auction clauses, said the proposals now made were only an extension of the principle of the auction clauses to which Sir Courtenay Boyle, the Permanent Secretary of the Board of Trade, and the Earl of Morley, the Chairman of Committees in the House of Lords, had both assented. It had been found, when selling the stock, that the full market value could not be obtained at the Auction Mart; and last time there was something like £22,000 out of £30,000 left on the hands of the Company. It was provided by Act of Parliament that the Company might offer this unsold stock to the shareholders at the reserve price; and it occurred to him that it would be a good thing, instead of offering it to the ordinary shareholders, to try to get the consumers to be shareholders. He submitted this to his colleagues on the Board, who approved of the idea; but it was hardly within the lines of the Act of Parliament, though he was informed by Sir Henry Calcraft, who was then Permanent Secretary to the Board of Trade, that they would not raise any obstacle. The Company then sent out with their gas bills a circular informing every consumer that the stock was offered in amounts of £5 and upwards, in order to give small capitalists an opportunity of investing in gas stock. The result was that a great deal more than the amount of stock for disposal was asked for. Sir John Hutton, the late Chairman of the County Council, had said, in a speech delivered in the course of last year, that he thought that large corporations ought to give facilities to small investors to put money in their stocks in small sums, rather than issue them in large amounts. The effect of the South Metropolitan Company's system (first adopted in 1890) of issuing stock to their customers was that at the present moment there were 1779 consumers who had taken up £110,000 of stock between them, or an average of £62 apiece. This stock had realized £269,000. It had usually been issued at Christmas. But there was no issue last Christmas; and consequently the Secretary had been inundated with applications from consumers to know when more stock would be available. This had proved very successful, not only with the consumers, but with the employees of the Company. The latter to the number of 358 had purchased about £6000 of stock, for which they had paid £14,500. Their investment averaged £17 of stock apiece. It was a singular thing that it was divided among officers and workmen in this way: 43 officers and 315 workmen; and in each case their average investment was £17 of stock, or nearly £50 in money. It was really to obtain the authority of Parliament to do what the Company had been doing for the past four years that they asked to include the consumers—in fact, to offer stock in the first place to the consumers and employees at the market price of the preceding week, subject to the approval of the Board of Trade, and then, if it was not taken up at that price, they proposed to go to auction as before.

Mr. LYTTELTON: You have, I believe, obtained the assent of all except one of your shareholders to the conversion of the shares into one denomination?

Witness: We have got down to one. The last letter I received this morning.

That is a purely domestic matter, which has no effect at all upon the public, except so far as it will enable you to deal with your shares to greater advantage, and so to benefit the consumer?—It is thought that, if we have one stock, it will realize a slightly higher price on the market than these broken-up stocks have done. Since 1876, we have raised under the auction clauses £1,428,000, of which £490,000 consists of premiums. Part of this has been share capital and part debenture stock. The total, including the premiums, is £455,000 share capital, and £973,000 debenture stock. The average rate of interest on the share capital has been £5 13s. 3d., which the investor gets; and the average rate of increase on the debenture stock is £3 15s. 6d.—giving a general average of £4 7s. 9d., on which the capital required by the Company has been raised for all new works in the last fifteen years.

Do you find any inconvenience at present in taking a full year for the calculation of the sliding-scale?—I cannot say that we have found any practical inconvenience, because we have not paid our dividends up to the hilt; and we have seldom had to raise the price of gas—only once, I think, since the sliding-scale came into operation in 1891.

After the strike?—It was the coal famine. We did not make the gas consumers pay for the cost of the strike when we raised the price of gas in 1891. According to the wording of the Act, we should have paid too high a dividend for the first half of the year; and it would have had to be adjusted in the second half. It so happened that, though we were selling gas at 2s. 3d., we were only paying the dividend due to 2s. 6d., and so no difficulty arose.

But if you paid the dividend up to your full powers, a difficulty would arise?—A difficulty would arise.

And as you desire to pay a dividend every six months, you want a clause such as this?—Yes; we must have it.

I believe part of your scheme, as to the appointment, by holders of small stock, of nominees to receive their stock, without the intervention of the probate laws, has been approved by the Treasury?—We adopted the principle of profit-sharing in 1889; and this has extended or developed into shareholding. We expect in a very short time that the whole of our employees will be shareholders in the Company; and as these workmen's holdings will not amount to very much, we thought it would be an advantage if we obtained permission from Parliament to adopt the provisions of the Post Office Act for the disposal of these small amounts. In fact, I may say that the principle on which we have acted has been to endeavour to make the whole of our employees co-partners in the Company; and these proposals are brought forward for the purpose of facilitating the arrangement. I myself wanted to go further, and arrange so as to make the workmen, when they had sufficient holding, directors; and I hope to do this yet some day. What we desire is to facilitate, by every possible means, the investment by our workmen in the Company's stock. The Treasury have proposed some amendments to bring the Bill in harmony with the Finance Act of last year; and these have been incorporated.

Subject to those amendments, the Treasury are in entire concurrence with the proposals contained in the Bill?—Yes.

Mr. FREEMAN (in cross-examination): Clause 8 comes to this, does it not, that, before submitting your new issue of stock to the operation of the auction clauses, you may offer it to your consumers and employees at the price of the preceding week?

Witness: No; that is hardly the way to put it—before submitting it

for sale by public auction or tender. I contend most emphatically that this is bringing it under the operation of the auction clauses, but in a different way.

So far as your Company are concerned, the auction clauses were introduced in 1876?—Yes.

And your Company vigorously objected to the introduction in your Bill of such provisions?—I was the principal witness for the Company, and I said: "As a shareholder, I do not like them; but I say nothing against them—they are fair."

Then you do not know that your Counsel protested altogether against the auction clauses being put into the Bill?—I dare say he did. I am not responsible for what Counsel might say.

They are now introduced, are they not, into all gas companies' Bills, in conformity with the Standing Orders of Parliament?—Yes.

Can you suggest in this case any special reason why a departure should be made from the established custom of the auction clauses?—Yes; I can give two reasons. The first is that, by offering the shares to the customers in the way proposed, we shall get 2 or 3 per cent. higher premium, as, in fact, we have done for the last four or five years. Another reason is that, in the light of the experience we have gained, it is highly advantageous to the public—to small people especially—to limit the issue to small amounts, so as to give them an opportunity of investing their money in a safe security.

Under the auction clauses you have all the benefit which you speak of now?—No; we have got it, I will not say by an evasion of the Act of Parliament, but by not acting in accordance with the strict letter of the Act. We put up some stock for sale by auction, and we could not sell it at the market price. We then, instead of offering it to the shareholders at the reserve price, adopted the plan of offering it to the consumers.

You would agree with me, no doubt, that the object of the auction clauses is to get the largest possible premium on the stock which is being offered?—That is what we want.

And if you offer it under the ordinary auction clauses, of course all the people who now apply for it would compete with other people for purchasing it?—No; they cannot.

Why not?—They cannot attend the Auction Mart; they do not understand it. If you desire to give these people facilities to invest their money, you must say to them: "You can have this stock at such a price." But if you ask them to go through the formality of tendering, or to attend the Auction Mart, they will not do it. It is not practicable.

Is not the effect of what you are seeking to do that you withdraw a certain amount from the competition of all classes, including these people, and offer it to other people at a certain value which you yourselves fix?

Mr. POPE: Not that we fix.

Mr. FREEMAN: Yes; that you fix.

Witness: I beg your pardon. The value is fixed by the market. The clause says that we shall offer it at the market price of the preceding week, subject to the approval of the Board of Trade.

Is there any reason why your Company should be different in this matter from any other?—No, they ought all to be the same; and if I had my way, I would certainly compel gas companies to offer their stock to the consumers.

Then what you are really asking Parliament now to do is to make a precedent which, in your opinion, should apply to all gas companies, overriding the existing auction clauses, and providing fresh machinery?

Mr. POPE: No.

Witness: No; not overriding, but extending and improving them.

Mr. FREEMAN: Under your scheme, these auction clauses would not be reached at all, because the whole of your capital might be taken up by your consumers or by your workpeople?

Witness: All the better.

So far it would override the auction clauses?—But it would be in strict accordance with the principle of the auction clauses.

Is not the object of altering the stock from a 10 per cent. stock to double the amount of 5 per cent. stock, that, by having a larger capital with a 5 per cent. dividend, it may not be so patent to the public what you are earning?—It would be patent to the public what we earned—the real earnings, not fictitious earnings.

That is the injustice, is it; and that is all?—Yes. It is an anomaly, at any rate.

If this alteration were made, to remedy what you conceive to be an injustice, would it not equally apply to the water companies?—The water companies have not been subject to the auction clauses for anything like the period that we have been under them.

Where is the distinction between the two?—I base my main argument on the ground that it is a necessity, in consequence of the operation of the auction clauses. We have been under those clauses for about nineteen years; whereas the water companies have only been subject to them for something like two years, and have practically raised no capital under them.

By such an alteration as you are proposing, you benefit very much the old capital?—Well, personally I do not see it. It only means that the nominal value of the stock is increased. My income is not increased at all; and at my death the Chancellor of the Exchequer will get more out of my successors.

While you are alive, supposing that you want to sell converted stock, you would get more for it than you would have done before?—Yes, a little; but not much.

Then the whole benefit, so far as it relates to the old stock, is not to the consumer, but to the shareholder?—Yes.

By the COMMITTEE: Under the proposals in the Bill, the Directors would have power to sell stock during a strike; but they would never think of exercising it. It would be to their interest to get as high a premium as possible, just as much as it was the interest of the public, because the lower the amount of interest at which they could raise their new capital, the more would be left for them, in the shape of profit, to reduce the price of gas and to increase the dividends. For instance, taking the million and a half they had raised at £4 7s. 9d. during the past fifteen years; if this had been raised at 7 per cent., it would have taken about £40,000 a year more to pay interest upon it. That would have necessitated an increase in the price of nearly 2d. per 1000 cubic feet. So the public would have had to pay the £40,000, and the Company would have suffered in dividend to the extent of ¼ per cent.

The CHAIRMAN: You have hinted, in the course of your evidence, that you yourself are rather friendly to the proposal that the workmen should be directly represented on the Board of the Company?

Witness: I am most strongly in favour of it.

In answer to further questions by the COMMITTEE, witness said he admitted that, so far as the old shareholders were concerned, the Company were asking for some advantage in the market value of the old stock; and he was perfectly well aware that a company had no right to come to Parliament, and ask for special advantages simply for their own benefit, unless they could prove some public good. The general advantage was the offer of the stock to the consumers and to the workpeople, so as to allow small capitalists to invest their money. He was very anxious to do something towards settling the labour difficulty; and he thought it would be an advantage if the workmen had representation on the Board as a result of being shareholders. His idea was that the election should be by ballot, and that only those holding shares in the Company should have a right to vote; and that the scheme should not be brought into operation until all the employees were shareholders. Generally speaking, the matter should be left in the hands of the men; and the Board should not exercise any veto. He disapproved of a veto altogether.

The CHAIRMAN: The Committee have decided to communicate with the Board of Trade, and ask for some official to give evidence as to their approval of the proposed alteration.

Mr. DALZIEL: Do I correctly understand that the opposition of the County Council is only directed to certain clauses of the Bill.

Mr. FREEMAN: They only object to a certain portion of the Bill. They do not desire to intrude upon the "domestic arrangements" of the Company.

Mr. POPE: I do not know so much about that. You object to our conversion of the capital; and that is the essence of the Bill.

Mr. FREEMAN: That is not "domestic."

As this closed the case for the Bill,

The CHAIRMAN said: It is perfectly evident the case is so mixed up with the Board of Trade, that I do not think it would be fair to Counsel for the County Council to call upon him to lay his case before the Committee without having heard the evidence which will be practically called by the Committee themselves. So we will adjourn until Thursday.

Thursday, March 28.

On the resumption of the proceedings this morning,

Sir *Courtenay Boyle*, K.C.B., the Permanent Secretary to the Board of Trade, attended (by special request) to give the views of his department upon the proposals contained in the Bill.

The CHAIRMAN: We have asked you to give us your presence here to-day on the question of clause 8. It has been stated in evidence by Mr. Livesey, the Chairman of the South Metropolitan Gas Company, that they have already contravened the Standing Order by issuing shares to their employees and to the consumers; and we understand that it has been to a certain extent with the concurrence of the Board of Trade. Can you give us any information on this subject, and as to whether it meets with the approval of the Board, and whether there has been any correspondence on the subject?

Witness: Yes, Sir. In the past procedure of the Company, the Board of Trade has been aware that, not being able to get tenders for the stock placed out at the reserve price under the Act of 1881, the Company have offered the stock at that reserve to their employees and to the consumers. This has worked tolerably satisfactorily; and certainly it is a system which has, up to the present, met with the approval of the Board of Trade, because, in the opinion of the Board, it is desirable that both the consumers and the employees of the Company should be brought into the position of having a direct interest, of a limited kind, in the affairs of the concern. Therefore, when clause 8 was brought under the notice of the Board of Trade by a letter from the authorities of the other House of Parliament, the Board directed me to reply to the principal officer of the House—the Counsel to the Lord Chairman—in favour of the clause as it appears in the Bill, and certainly in favour of the principle of the clause. If the Committee desire to have this correspondence, I am authorized by the Counsel to the Lord Chairman to produce it. Perhaps I might read the principal parts of it. This is the gist of the letter:—

For some time past, it appears to have been the practice of the Company, when offering stock for sale, to fix the reserve price so high at each sale that very little stock was sold, and instead of offering the unsold stock to the shareholders, as provided by the auction clauses, to offer it to the consumers and to their workmen, in small lots of £5, £10, £15, and so on, at the reserved price. The stock appears to have been readily taken up by the consumers; and in a letter to this department on the 30th of January, 1893, the Company stated that, by the adoption of this plan, 1346 consumers had become shareholders, with an aggregate holding of £86,895, or an average of £65 per shareholder, and that they had had to disappoint a large number of applicants. In clause 8 of the Bill, the Company propose to reverse the practice they had adopted of first offering the stock for sale by auction or tender, and then offering the unsold stock to the consumers and workmen. The proposal is that, provided the approval of the Board of Trade is signified in writing, the stock shall be offered to the consumers and to persons in the employ of the Company at not less than the average market price of the stock in the week immediately preceding the offer; and that any stock not so sold shall then be offered for sale by auction or tender. This is probably to avoid the trouble and expense of attempting in the first place to sell the capital by auction or tender at the price the Company can obtain for it in small lots from the consumers. Lord Morley is fully aware that by the operation of the auction clauses, coupled with the sliding-scale, it is in the interests of the consumers as well as of the existing shareholders that the highest possible price should be obtained for the capital offered for sale. The proposal made in the clause, that the sale to the gas consumers and to persons in the employ of the Company shall be subject to the approval of the Board of Trade, appears to be sufficient to ensure that the capital will be offered at not less than the market value for the time being. But the Board of Trade conceive that the object of the proposal is not so much to obtain a high price for the capital as to strengthen the position of the Company by the creation of a body of consumers and employees personally interested in its welfare. The object appears to be one worthy in

itself; and, as I have already pointed out, Parliament sanctioned a somewhat similar proposal in an Act of 1893. Under these circumstances, the Board of Trade are not prepared to raise any objection to the proposal, which they believe well worth the favourable consideration of Parliament.

In order to be quite fair to the Counsel for the Company, I ought to say that the letter raises certain questions upon other clauses. It points out, for instance, that some consequential alterations would be necessary if the 10 per cent. stock were altered into 5 per cent. stock, and the 1d. was altered to ½d. The letter also points out that, before a reduction of price can be held to authorize an increase of dividend on the sliding-scale principle, the reduction should be for the whole of the half year, and not for a portion of it. That is a point to which the Board of Trade has thought it necessary to call attention. The reason for this is that the consumption of gas in the first three months of the winter half year is much higher than in the last three months of the summer half. Consequently, it would not do to have a low price for the summer part when a high price was charged for the winter portion. This and one or two other points are raised in the letter, which will no doubt come before the Committee.

Mr. *George Livesey*, recalled, said he desired to make it quite clear that, when he expressed himself as being in favour of having workmen representatives upon the directorate, he was speaking only for himself. He wished it to be made perfectly clear that he was not speaking in his official capacity, but only giving his personal opinion. The majority of the Board objected to the proposal.

Asked by Mr. WORSLEY TAYLOR as to the market price of the stocks of the Company before the introduction of the Bill and since, witness said that, taking the figures from the weekly reports given in the JOURNAL OF GAS LIGHTING, the "A" stock stood at £333-38 on Nov. 10; and on March 26, it was quoted at £355-65. The "B" stock in November was £280-85; and in March, £293-98. The "C" stock in November was £288-93; and in March, £307-12. In order to show how all gas stocks had risen during that period, he would take the largest gas stock in London—in fact, he might say in the world—The Gaslight and Coke Company's "A" ordinary stock. This was quoted in November at £248-52; and this month at £265-70. He could give other examples, but that was sufficient.

Mr. WORSLEY TAYLOR: Have all gas stocks risen in like manner? For instance, has not that which is called their ten per cent. "J" stock an absolutely fixed dividend?

Witness: It has. It is a 10 per cent. preference stock. It stood at £275-80 in November; and it is precisely the same now. But you must remember it only pays £3 11s. 5d. per cent. as an investment.

Can you give me the total nominal amount of the gas stocks in the Metropolis? Is it about £15,000,000 or £16,000,000?—Speaking roughly, including shares and debenture stock, The Gaslight and Coke Company approach £12,000,000; we approach £3,500,000; and the Commercial Company approach £1,000,000.

Mr. CRIPPS: Do you attribute the difference in the value of your stocks in November and in March entirely to what I may call a general rise in stocks?

Witness: Certainly. Stockbrokers tell me that they consider gas stock will become a 4 per cent. stock; and it is more in their hands than in the hands of anybody else.

It is changing now from a 5 per cent. to a 4 per cent. stock, is it not?—Yes. This has been going on for the last twelve months.

Exactly the same tendency is shown in regard to The Gaslight and Coke Company's ordinary stock?—Yes.

As regards the preference stock, there is a fixed 10 per cent. dividend; and the same reasons would not apply to that as to the ordinary stock, would they?—It is considered to be a perfectly safe security; and it has gone up about as high as people will give. It only pays about 3½ per cent.

Mr. CRIPPS, referring to the Standing Order which provides that, in every Bill by which an existing gas or water company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender at the best price which can be obtained, pointed out that the Bill was not technically speaking one for authorizing the Company to raise additional capital, and that it was only after the Company had unsuccessfully offered the capital for tender by public auction that the stock could be taken up by the consumers.

The CHAIRMAN: Do you propose to submit a clause in the terms of the "Instruction" to the Committee which was moved and carried in the House yesterday (*ante*, p. 701).

Mr. CRIPPS: We are representing here the Company *quâ* Company. Mr. Livesey has explained what his individual view is; but that is not the view of the Company. I do not mean to say exactly that there is any difference of opinion between Mr. Livesey and his colleagues. But the Company *quâ* Company are not promoting a Bill with any such clause in it; and, as a matter of fact, when the Bill was presented to the shareholders, and some question was raised about it, it was pointed out to them that there was no such clause in the Bill, and that, of course, we could not proceed with it as a Company without the consent of the Board and the shareholders, which had not been obtained. I do not know what attitude the Committee will take upon a clause of that kind. So far as we represent the promoters or the Board, it is impossible for us to bring it forward ourselves.

The CHAIRMAN: I quite appreciate that.

Mr. WORSLEY TAYLOR then addressed the Committee in support of the opposition of the London County Council. He said that this body did not desire in any way to obstruct or to stand in the way of the accomplishment of that which the Committee might find to be the reasonable and legitimate requirements of the South Metropolitan or any other Gas Company. All that they desired was that, whatever was done, should be done only after the fullest consideration of what was, directly and indirectly, involved in the Bill. If the Committee came to the conclusion that the ultimate interests involved were so great and so wide that they ought not to be dealt with incidentally, through the medium of this particular Private Bill, they would allow the opportunity for further consideration of the whole subject. In this case, there was one Gas Company, and one Gas Company alone, asking Parliament to repeal, upon certain vital points, the legislation passed, after the most careful consideration, in 1876. If the Committee passed the Bill, a precedent would have been created which must be followed in the case of every single gas company not only in the Metropolis, but throughout the whole length and breadth of the country. The question involved was an enormous one, which ought only to be decided by the light of all possible information which could be given upon it, and in full view of all the circumstances that might attend the passing of such a Bill. The avowed object of the scheme of stock-splitting was to increase the value of the stock of the South Metropolitan Company. It was suggested, at the outset, that the consumer would benefit, because there would be a larger amount of actual cash received per share. But it had been pointed out that this could only apply to the £600,000 (and odd) of unissued capital; whereas the proposal under consideration would apply to both the old stock and the new. Therefore it would affect the market value of the £2,140,000 of existing stock. Mr. Livesey, with his usual frankness, had admitted that no one would benefit but the holders of the stock. But with this Bill they might go into the market to-morrow, and get more for their stock than they could obtain to-day. This stock-splitting proposal was a gigantic operation; and if it was acceded to in this case, it could not be refused in the case of other gas companies. The result would be that, by a stroke of the pen, the value of the whole of their nominal capital would be largely increased. But something more followed. What was good for gas companies was good for water companies. Grant this to water companies, and mark what would happen? The result of the passing of this Bill would make it possible for them to go before Arbitrators or before Committees and say: "We are so much more valuable than we were, because we could get this power, or we have already got it." In case of purchase, that would involve an "immediate and unquestioned" rise in the purchase price (to quote Mr. Livesey's own words) of the water undertakings as against the ratepayers of London. Unless the present Company could show a strong public reason, the Committee would not be justified in relieving them from the necessity of complying with the Standing Order relating to the issue of shares; and he submitted that no such ground had been shown for creating a specially favoured class of shareholders such as were termed in the Bill "consumers." Consumers would include the whole population of London; and if the auction clauses were given the "go-by" in their case, the same thing must apply to the whole country, and practically the whole of the stock of the gas companies might be absorbed by the consumers and the Company's workpeople. Under cover of these words, the stock-jobbers would be given the power to manipulate the market prices—the price at which the stock was to be issued; and so get allotments of stock, through the instrumentality of nominees who were merely technically consumers. At the worst, all that could happen to the South Metropolitan Company, if the Bill were rejected, was the deferring of the matter for a year. Therefore, he asked the Committee, for the reasons which he had given, to withhold their sanction for the present.

The Committee then deliberated in private for some time. Upon the re-admission of Counsel and parties,

The CHAIRMAN said: The Committee have considered the matter very carefully; and they are not prepared to approve the preamble of the Bill so far as the stock-splitting clauses are concerned. That practically only leaves clause 8, and any clause that hangs upon it, together with the schedules and the "Instruction." The question is whether the promoters are prepared to go on with the Bill on its being emasculated in this way.

Mr. CRIPPS (having conferred with his clients) said: Having regard to the decision of the Committee, Sir, we do not think it will be worth while to proceed further with the Bill.

The Chairman of the Committee subsequently presented a report to the House, in which, after quoting the instruction received in regard to the workman-director proposal of the Company, he stated that the Committee had proceeded to examine the allegations contained in the preamble of the Bill, and had amended it by striking out so much as related to the conversion of stocks, but that the parties promoting the Bill had announced it was not their intention to proceed. He further stated that the Committee had agreed to the following special report: "That the Committee considered that the subject of conversion of stocks was one of so far-reaching importance that it ought to be dealt with by a Committee specially appointed to consider the same as affecting gas and water companies."

The York Water Company's Bill.—The Chairman of Committees of the House of Commons (the Right Hon. J. W. Mellor) has made the following report from the Committee on the York New Water Bill: "A report from the Local Government Board upon the Bill had been referred to the Committee, and considered by them, and they have adopted such of the recommendations contained therein as appeared applicable to the case as submitted to them. The Bill authorizes the Company to raise additional capital for the purposes of their undertaking. It was proved to the Committee that the Company were making large concessions to the consumers by reducing the charges for the water supplied for all public and private purposes within the city of York, by placing a limitation upon their right to make up back dividends, and by furnishing the Corporation of York with a gratuitous supply of water for their automatic flushing-tanks for flushing the public sewers and drains, and were providing improved means for extinguishing fires. The maximum dividends on the new share capital and the interest on the new loan capital are, moreover, limited to 3½ per cent. per annum. The Committee are therefore of opinion that the insertion of a provision in the Bill for the offer of such capital by public auction or tender ought not to be required." He further reported that the Committee had amended the preamble and the Bill generally.

Stoking Machinery for the Tradeston Gas-Works, Glasgow.—The Glasgow Corporation Gas Committee have lately accepted an offer by Sir William Arrol and Co., Limited, to provide and fit up, at the Tradeston Gas-Works, two retort-charging machines, with hydraulic motors attached.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE (IRELAND)—CHANCERY DIVISION.

Friday, March 22.

(*Before the* MASTER OF THE ROLLS.)

The Attorney-General (at the Relation of Adam S. Findlater) v. The Lord Mayor and Corporation of Dublin.

This was a motion for an injunction to restrain the defendants from summoning or holding a meeting for the purpose of taking a second poll of the ratepayers of Dublin with reference to the promotion of the Dublin Corporation Bill, 1895, and from applying the rates of the city either towards the expenses of this meeting, or towards the further promotion of the Bill. Five special defendants were named—the Right Hon. the Lord Mayor, the Right Hon. Alderman Joseph Meade, LL.D., Alderman Maguire, and Messrs. Hutchinson and Brown. The result of the motion was briefly recorded in the JOURNAL last week (p. 660); but it will be of interest to give the arguments and the judgment.

Mr. W. KENNY, Q.C., M.P., Mr. MEREDITH, Q.C., and Mr. T. C. DRURY appeared for the plaintiff; Mr. C. O'CONNOR, Q.C., and Mr. P. O'C. WHITE, for the Corporation; and Mr. PIERS WHITE, Q.C., Mr. J. J. CLANCY, M.P., Mr. RONAN, Q.C., and Mr. F. FLEMING represented the special defendants.

Mr. KENNY, in opening the case, said he applied, on behalf of the relator, for an injunction to restrain the defendants—first, from summoning or holding another meeting of the ratepayers for the purpose of submitting to them a resolution in favour of the promotion of the Improvement Bill; secondly, to restrain them from applying the city rates towards the expenses of any such meeting; and, thirdly, to restrain them from applying the public funds or rates towards the expenses of promoting the Bill; and costs were applied for against the special defendants. The meetings of the citizens were held under the Borough Funds (Ireland) Act, 1888, the sections of which provided that governing bodies, such as the Municipal Council of the City of Dublin, might resolve by a majority to promote Bills and apply the rates towards the expenses, provided the proceedings were confirmed at a subsequent special meeting of the governing body. Section 7 of the Act specified that no expenses either of promoting or opposing any Bill in Parliament should be charged against the rates, unless such promotion or opposition should have been approved of by a special resolution of the persons qualified to vote at an election of the members of the governing body of such district, to be passed at a meeting duly summoned as provided for. The statute regulated as to how the meeting should be summoned and conducted; and among the provisions, it was laid down that, after the resolution should have been declared to be either passed or rejected, if a poll should be demanded by five persons qualified to vote, it should be taken. All expenses incurred up to the declaration of the result of the poll were legitimately chargeable against the rates. The provisions of the Act, and the regulations contained in the schedule, were duly observed down to the taking and declaration by the Lord Mayor of the result of the poll of the ratepayers with relation to the Improvement Bill. A majority of 123 was recorded against its promotion; and the Lord Mayor complied with the regulation in the schedule, which directed him to transmit to the Local Government Board the figures and the result of the poll. In the face of that—and this was the point of the present application—the Lord Mayor and the special defendants named in the writ were not satisfied with the result of this vote of the ratepayers of Dublin; and so they determined to hold another meeting, and have another poll. Accordingly, they had advertised, under the provisions of the Borough Funds Act, 1888, another meeting for the 8th of April, for the purpose of again putting apparently the same resolution that was moved at the previous meeting, and again, if demanded, taking a second poll. He submitted that there was nothing in the Act of Parliament, or in the rules, indicating that a second poll could be taken, unless, of course, there had been some irregularity in connection with the first, or by reason of a *mandamus* from the Queen's Bench Division directing a second poll. But there was no suggestion, in the affidavits filed in the present case, that there had been irregularity of any sort in connection with the resolution of the Corporation, the general meeting of the ratepayers, or the taking of the poll, where declaration by the Lord Mayor had been lodged.

The MASTER of the ROLLS: How long do you say the resolution binds?

Mr. KENNY said for the whole session of Parliament, as regarded that particular Bill. There was nothing to prevent them from promoting a new Bill by Dec. 21 next. But upon the present Bill, this poll was a final and binding decision of the ratepayers; and all he was seeking to restrain the Corporation from doing was applying the funds of the district. The Corporation were the promoters of the petition filed on the lodgment of the Bill. Let them get other promoters; but, under the Borough Funds Act, they were not entitled to employ the city rates in defraying the expenses of the further meeting proposed, or in connection with the promotion of the present Bill. The learned Counsel then gave a chronological account of the meetings held in pursuance of the provisions of the Act. He then went on to say that the main defence of the Corporation was that, on the 5th of March, a guarantee of indemnity was signed by several members of the Council and the Town Clerk; and the special defendants said they did not intend to apply the rates of the city towards liquidating the expenses of the meeting or the poll. The total amount guaranteed was £149. The case made by the Lord Mayor in defence of a second poll was that, because only 2165 ratepayers voted against the Bill, and a large section of them were too apathetic to vote at all, the Council would be wanting in duty if they submitted to the opinion of about one-fourth of the citizens upon the Bill. He (Mr. Kenny) and his learned friends had searched for authorities for the purpose of seeing whether or not there was any precedent for the holding of such a second poll in a case of this kind; and they could not discover a single one. The Lord Mayor and the city officers had said that such cases had occurred. But none were cited in the affidavits filed; and he challenged them to state a single case where a second poll had been taken, the first being a regular and legitimate one. Three affidavits had been filed in opposition to the present application; but in none of them was the main question raised by the motion dealt with, for in none was it denied that the promotion of the Bill would be at the expense of the rates. This was the real question. A second poll would lead to confusion; and if it was allowed to take place, what would prevent the minority demanding a third?

The MASTER of the ROLLS: Supposing a second poll is taken, and a smaller number vote, or a majority smaller than the number who voted against the Bill on the first poll vote for the Bill, which is to prevail?

Mr. KENNY said it would lead to great confusion. Having referred to certain authorities, Counsel submitted, in conclusion, that the statute never contemplated a second poll of ratepayers on the same Bill in the same Parliament.

Mr. O'CONNOR then opened the case on behalf of the Corporation. At the outset, he stated that the defendants did not dispute the jurisdiction of the Court to grant an injunction to restrain a corporate body from applying their funds in the promotion of a Bill, unless they were entitled to do so under the Borough Funds (Ireland) Act. They did not come into Court to contest that point; but whether, after a meeting was once held, there could be any subsequent meeting. This was a most important matter. The case would rule every other of a similar kind which came under the Act. But, although it was an important question, it was a very narrow one, and one to be determined by the construction of the Act itself. He would therefore have to ask his Lordship to consider the circumstances under which the Corporation had come to the conclusion that, in the interests of the ratepayers, the meeting should be held. In the joint affidavit which had been filed, the special defendants stated that they believed that a large number of the ratepayers were misled by misrepresentations which seriously affected the result of the poll—inducing a large number of ratepayers to abstain from voting altogether, and a good many to vote against the Bill, and that the poll could not fairly be taken as an evidence of the opinion of the majority. In addition, it would be highly inconvenient if, in a case where there was misrepresentation, and where the declaration of opinion as indicated by the poll was influenced by that misrepresentation, the governing body of the city, who were placed in the position of people who were to determine whether or not it was expedient that the borough funds should be applied, should have no voice whatever in the question whether the poll was to be taken as an index of the opinion of the entire constituency. Was it to be said that, because approval is withheld by a body of ratepayers at any particular time, they are debarred for ever afterwards from expressing approval? Counsel went on to add that it was difficult to find an analogous case to this in the history of law As he understood the common law, it was this—that every individual was allowed the right of changing his mind. Every corporate body was entitled to rescind a resolution previously arrived at. When his learned friend on the other side said no second meeting could be held, he should in addition have held that the ratepayers were to be stopped for ever afterwards from giving approval of a matter which at a certain time they disapproved of. He (Mr. O'Connor) submitted that there was nothing in the statute forbidding a second meeting; nor was there anything providing for a second one. The object of the Act was to find out the opinion of the constituency. The poll was a small one.

The MASTER of the ROLLS said he should think that 4000 out of 7000 was a very large one. Supposing that at the next poll 1200 ratepayers favoured the Bill, and 800 voted against it—in other words, that 1200 carried it as against about 2000 who were previously opposed to it—which poll was the one to decide?

Mr. O'CONNOR: The decision arrived at at a subsequent meeting must always rule. Are we to be restrained from holding a meeting during the present session of Parliament? Do they ask that the injunction shall go in a general form, and last during the present session? I submit that the injunction would have to go generally.

Mr. KENNY: Against the present Bill.

Mr. PIERS WHITE on behalf of the special defendants, said he had very little to add to what Mr. O'Connor had stated. This Bill was *bonâ fide* promoted in the interests of the city; and it was of a legitimate character. He submitted that his Lordship could not say that the taking of a second poll was prohibited; the one already taken having been of an unsatisfactory and inconclusive character.

Mr. MEREDITH having replied,

His LORDSHIP said he would deliver judgment on the following day.

Saturday, March 23.

The MASTER of the ROLLS, in delivering judgment this morning, said that, at the close of the arguments on the previous day, he had no doubt as to what his decision would be; and the reading of the Borough Funds Act had confirmed him in his opinion. That Act was passed to meet a state of things that had produced great difficulties, which chiefly arose in this way: The governing body of a municipality or trade organization was in the position of trustees; and the application by such a body of trust funds to any purpose, however beneficial, but not within the strict lines of their trust, had been constantly held to be *primâ facie* a breach of that trust. The Act of 1888, on which exclusively the application before him depended, was passed to confer upon municipal authorities, under certain circumstances and restrictions, authority to apply their funds to the purpose of obtaining beneficial legislation. The third section of the Act gave the governing body power to apply the borough funds or rates for the purpose of promoting or opposing any local Bills, and to determine from what particular fund the costs and expenses should be drawn, or on what rate the burden of their payment should be cast. The fifth section imposed very important restrictions as to the manner in which these funds should be used. They could only be applied in pursuance of a resolution passed by an absolute majority of the governing body, at a meeting of which ten clear days' notice had been given by a newspaper advertisement, such notice to be in addition to the ordinary notices required for announcing such

meeting. In the case of the promotion of a Bill in Parliament, no further expense could be incurred or charged after the deposit of the Bill, unless the propriety of the promotion of the measure were confirmed by an absolute majority at a special meeting of the governing body, held not less than fourteen days after depositing the Bill. All these checks were outside the electoral body of the constituency; but the seventh section stated that no expenses incurred in the promotion of the Bill should be charged unless that step had been approved of by a special resolution of the persons qualified to vote for the election of the governing body, at a meeting summoned by the Mayor, or the Chairman of the governing body, by advertisement in the newspapers. A month's notice was required for this meeting—a longer notice than he recollected in any other Act of Parliament. The object of the notice apparently was that everybody should have the fullest opportunity of considering everything in connection with the Bill. There was a distinct enactment that this meeting should decide one way or the other about the Bill by a majority; and after the long notice, one would say that the determination of this meeting would be final and conclusive. There might, however, be difficulty in bringing the notice home to everybody; and the meeting might not, after all, represent the feelings of the entire body. But this was provided for by the Act, which stated that five duly qualified persons at that meeting could demand that a poll should be taken; and whether the meeting or the poll, if demanded, voted on the question, the word used in the Act was that final and complete word "decide." Mr. O'Connor had argued that there might be more meetings than one; and that the Legislature contemplated this. The word "meetings" used in the Act, and on which Mr. O'Connor had based his argument, was not incorrect; but the word was not to be taken as applying to one constituency, but to Cork, Dublin, and elsewhere, and to meetings which could be held in any one constituency from year to year under that Act. It was pressing the argument too far to claim that this word meant anything more. The further provisions of the Act dealing with voting-papers also showed the great care taken by the Legislature that every voter should have the fullest opportunity of recording his opinion, and that no one but a qualified person could vote. It was impossible to read this code without seeing that it was intended and framed for the purpose of rendering the appeal to the constituency complete, final, and effective. In the words of the Act of Parliament, "the poll shall decide the question." In the present case, that the proceedings had been regularly taken under the Act was not questioned. Everything had been formally and regularly done. The holding of the public meeting was formal and regular; and the poll was formally and regularly taken, and resulted in a small majority (the exact figures were in dispute, but this did not matter) against the application of the powers of the Act to the Bill being promoted by the Corporation. The Corporation, considering, no doubt, the Bill to be a most valuable and beneficent measure, and one that ought to be passed, were naturally disappointed at the result of the poll. More than that, they had stated in their affidavits that they believed the adverse vote was founded to a large extent upon misconception, and even the word "misrepresentation" was used. He could not decide as to whether or not the result was obtained by an inaccurate knowledge of the purport and scope of the Bill. Many ratepayers might not have understood it; and there might have been misrepresentation in that way. But was it to be supposed that a poll taken in accordance with the requirements of Parliament, was to be set aside on the suggestion that there were different views and different opinions as to the effect of the measure concerned? If people did not choose to inform themselves in the month before the meeting as to the effect of the measure, so much the worse for them. It was said that there was nothing in the Act inconsistent with the taking of a second poll. It seemed to him that it lay upon the Corporation to show that there was some power to allow it; but they had entirely failed to do so. He was clearly of opinion that there was nothing in the Act to enable any second meeting or poll to be held within the same session of Parliament; and therefore the Attorney-General was entitled to the injunction for which he asked. It would, however, have to be modified to state what he meant. It was not intended in any way to prevent application to Parliament. This might be done by private individuals, at their own risk and expense, if they chose. He would not grant any injunction that would restrain the Lord Mayor or anybody else from holding a public meeting for any purpose; but it must not purport to be held under the Borough Funds Act.

Mr. KENNY: That is all we ask.

The MASTER of the ROLLS, in reply to a question, said the costs of the application would follow as against the special defendants.

Mr. KENNY said, on this order being made, he would agree that the motion should be taken as a trial of the action.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, March 27.

(*Before Justices* CAVE *and* WRIGHT.)

Lear v. Shelley—The Quality of the Littlehampton Company's Gas.

This was an appeal by the Secretary of the Littlehampton Gas Company against a conviction for supplying, on Nov. 1, 1894, gas of less than the required illuminating power.

Mr. BOXALL, who appeared for the appellant, said the conviction was under section 36 of the Gas-Works Clauses Act, 1871; and the grounds of the appeal were that the other sections of that Act, which prescribed how the tests were to be made, and so on, had not been strictly complied with, and therefore the conviction could not be upheld. His objections were: (1) That, the report made and delivered to the Company being incorrect, no report had been made and delivered within the meaning of the Act; (2) that, assuming the report made to be good, it was not delivered to the Gas Company on the day following the tests; (3) that there was a condition precedent to the testing, that the consumption of gas should be carefully adjusted to 5 cubic feet per hour, and this not having been done, the report was bad; (4) that, according to the proper interpretation of the Act, the candles must be lighted in the photometer ten minutes before each testing, and as this had not been done, the tests were bad. The Magistrates had stated a case, in which they said they considered, in spite of these things, the default was clearly proved; and they had therefore convicted the appellants.

Justice WRIGHT asked if the penalty clause specified that the penalty was to be imposed if the gas were not of the proper quality, according to the method of testing mentioned in the other sections.

Mr. BOXALL said it did not; but his contention was that those clauses were imperative, and, unless they were fulfilled, the penalty clause could not come into operation.

Justice WRIGHT: Supposing the Gas Company admitted that the gas was not within section 36, would a conviction be bad merely because some of the tests were inaccurately applied?

Mr. BOXALL said he did not know what might be the effect of an admission—it might be equivalent to waiving the provisions of the Act in their favour; but he submitted that evidence must be given of testing according to the Act.

Justice WRIGHT pointed out that there was nothing to this effect in the Act.

Mr. BOXALL said the question was whether the Magistrates could convict when they had had evidence before them of testings made in accordance with the Act and the schedule which prescribed the mode of testing in detail. It was evident that the scope of the Act was not only to protect the consumers, but also the Gas Company; and it provided, among other things, that the report of the examination should be delivered to the Company on the day following the testing, which was evidently in order that the Company might be prepared to adduce evidence on their own behalf. He submitted that it was not competent for the Magistrates to hear evidence as to the quality of the gas, unless the procedure pointed out in the Act had been gone through.

Justice WRIGHT asked why they should not convict on satisfactory evidence. If there were substantial unfairness in the way the testings were conducted, the Justices would not convict; but these were perfectly trivial irregularities. If Counsel could make out that there could not be a conviction except exclusively on the evidence supplied by tests under the Act, he would succeed, because it was admitted that these tests were not so made.

Mr. BOXALL contended the stipulations in the Act were imperative.

Justice WRIGHT said they were no doubt imperative as to the testing; but this was not the point. He must make out that there could not be a conviction on other evidence besides that of testing. The case did not state that there was no other evidence.

Mr. BOXALL remarked that it was not suggested that there was any other evidence.

Justice WRIGHT said there was no question put to the Court as to whether tests under the Act were the only admissible evidence.

Mr. BOXALL having further pressed the matter,

Justice WRIGHT said: No serious harm will happen to you. On any other occasion, you can always object to a report of such tests being used in evidence. If you had raised the objection that, under the circumstances, the report was not receivable in evidence, you would probably have won the case; but that is not the point left to us.

Mr. BOXALL observed that the case did not say, in terms, that the report was objected to; but he submitted this was the meaning of it.

Justice WRIGHT: We cannot go outside the question asked us. It will not really hurt you, for the reason I give. Next time, if able to make out, either from the report itself, or from cross-examination, that the prescriptions of the Act are not substantially followed, then the Magistrates can easily be compelled to reject such evidence.

Mr. BOXALL: I understand your Lordships are satisfied that these tests, as prescribed in the Act, are not really conditions precedent to a conviction?

Justice WRIGHT: I do not say anything about that.

Mr. BOXALL: That is the point raised by this case, my Lord.

Justice CAVE: Clearly not.

The appeal was thereupon dismissed.

BIRMINGHAM COUNTY COURT.—Monday, March 25.

(*Before His Honour Judge* CHALMERS.)

Thompson v. The Corporation of Birmingham—Liability for Renewing an Improperly Laid Pipe.

This was an action brought by E. H. Thompson, a decorator, against the Birmingham Corporation to recover £2 1s., damages sustained by him by reason of the negligence or unskilful workmanship of the defendants' servants in October, 1892, when laying the water-service to the plaintiff's premises, known as "Mayscroft" and "Llangorse," Small Heath. The water-service from the main to the stop-tap, it was alleged, was laid without any covering or protection, with the result that it had become rotten and unfit for the purpose for which it was intended, and had had to be replaced by the plaintiff.

Mr. M'CARDIE appeared for the plaintiff; and Mr. HILEY, for the Corporation.

Mr. M'CARDIE said that in 1892 plaintiff bought some leasehold land in Charles Road, Small Heath, and erected a number of houses. He asked the Corporation to lay on the water-service; and the Department did so as far as the stop-tap—the fittings from that point to the houses being laid down by plaintiff. In June last year, plaintiff received a notice from the Corporation stating that a leakage had occurred from the fittings to the two houses "Mayscroft" and "Llangorse." The Corporation then sent workmen, who took up the road; and when the pipes were exposed, plaintiff found that, in order to comply with the demand of the department, it would be necessary to relay the whole of the pipe from the main to the stop-tap. The pipe had only been laid a year and a half, whereas, if the work were properly done, the pipe should last for fifty or a hundred years. Plaintiff discovered that the road was made partly of ashes; and the pipe was put in without any protection, although it was a notorious fact that pipes so laid would soon corrode. The pipe should have had a coating of clay, or some other precaution should have been taken to

prevent corrosion; and, in the absence of any protection, the plaintiff contended that the work was improperly done. The cost of relaying the pipe, &c., was £2 1s.; but it was a serious matter for the plaintiff, who owned twenty houses in the same thoroughfare, which had been supplied with fittings by the Corporation. If he had to relay the fittings to all these houses, it would be very expensive; and, as a matter of fact, he had already received notices from the Corporation in respect to some of the houses.

Plaintiff was called, and stated that he did not superintend the laying of the pipes; he expected the work would be properly done by the Corporation.

Aaron Jones, a plumber, and *John Chattaway*, clerk of works under the Birmingham School Board, asserted that pipes ought not to be laid in ashes without protection. Engine ashes were worse than household ashes; but all ashes were detrimental to pipes of every description.

George Bennett said he took up the pipe, and found it had been laid in chemical ashes, without any protective substance at all.

Mr. HILEY urged that there had been no negligence on the part of defendants' servants. The road was not made by the Corporation, but privately, and taken over by the Corporation. Most roads were made to a certain extent of ashes; and ordinary ashes were perfectly innocuous.

Thomas Clarke said he had been plumbing inspector in the employ of the Corporation for fourteen years, and prior to that had many years' experience in the laying of pipes. The service in the present case was properly laid, and in the ordinary way. When the pipe was taken up, he inquired where the ashes came from, and discovered that they were from chemical works. Ashes from chemical works were injurious, but ordinary ashes were not; and, as a general rule, it did not hurt pipes to lay them in ashes. He superintended the laying, on the average, of about 1000 services a year, which in length would be about five miles. Lead pipes, such as the Corporation used, ought to last forty or fifty years. It was impossible, when laying down pipes, to know what kind of ashes the roads were made of without an analysis. He disagreed with the witnesses for the plaintiff as to the effect of the ashes on the lead pipes.

His HONOUR said the question was one of fact—whether the pipe was, or was not, properly laid. The ordinary life of a pipe, it was agreed, was forty years at least; and this pipe seemed to have only lasted for eighteen months or two years. There was a conflict of evidence on the part of the witnesses as to the effect of ashes; but it was admitted that chemical ashes were injurious. If the Corporation did not think it worth while to make inquiries as to the kind of ashes used in making the roads, the least they could do when an accident happened, as in the present case, was to repair the damage. Judgment would be given for the plaintiff for 38s. and costs.

Embezzlement by a Collector of The Gaslight and Coke Company.

At the Central Criminal Court, on Wednesday, the 27th ult., Charles Ross, 36, pleaded "Guilty" to embezzling various sums of money belonging to The Gaslight and Coke Company. The prisoner, it may be remembered, had been a collector in the service of the Company, but absconded to America. His defalcations amounted to £345 9s. 11d. He was brought up at Bow Street a few weeks since, and committed for trial (*ante*, p. 545). He was sentenced to 18 months' hard labour.

A Curious Plea against the Payment of a Gas Account.

At the Manchester Police Court last Friday, a novel plea against the payment of a gas account was put forward by a lady named Frances Watson. The Court was asked, on behalf of the Corporation, to grant an order against defendant for the payment of her gas bill, amounting to £2 6s. 9d. The case was before the Court a fortnight previously, when it was proved that the gas had been supplied to the defendant, who at the time kept a tobacconist's shop in Bury New Road. The plea of infancy was raised—gas having been decided not to be a "necessary;" and the proceedings were adjourned for the production of the defendant's birth certificate. Mr. Burton, who defended, now put in the certificate, which gave the girl's age as 18; but as there was no evidence of identity, the Magistrate made the order for payment.

Explosion at the Saltley (Birmingham) Gas-Works.—At about four o'clock on Sunday afternoon last week, an explosion occurred in one of the foul mains in connection with No. 3 retort-house at the Saltley Gas-Works of the Birmingham Corporation. The explosion caused the destruction of a 24-inch pipe; but it was unattended by personal injury, inasmuch as the works are stopped between 6 a.m. and 6 p.m. on Sundays. The Engineer (Mr. H. Hack) was summoned; and, under his direction, the main was capped, and work proceeded as usual in the evening.

Tynemouth Gas Company.—The annual meeting of this Company was held last Tuesday. Mr. J. Moffatt presided; and, in moving the adoption of the report, he said that, like other gas companies, they had had a prosperous year. As shown by the balance-sheet, they were able to pay the usual dividends. The quantity of gas sold continued to increase; and during the past year the advance was at the rate of something like 6 per cent. The increase was largely due to the extensive use of gas-fires, gas-cookers, and gas-engines. The extension of Whitley and the neighbourhood had caused the Company to be asked to lay mains; and this would be done when the roads were formed. As a slight compensation for the prospect of an increased demand for gas, the Directors had seen fit to reduce the price by 3d. per 1000 cubic feet, to consumers in Whitley. In the course of the year, they had renewed the ammonia plant, which had become worn out and effete; and the new plant was not only working satisfactorily, but was producing a greater quantity of ammonia. They had also extended the purifiers, and effected other improvements in the works and plant. The report was adopted; and a dividend of 5 per cent. on the original stock, and of 3½ per cent. on the new share capital, for the past six months, was declared.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS COMMISSION.

Reports of the Engineers on Oil-Gas Processes.

At the Meeting of the Edinburgh and Leith Gas Commission on the 18th ult., reports by the Engineers on oil-gas processes were submitted, from which the following full summary is taken:—

Mr. R. Mitchell, Engineer of the Edinburgh works, in a report dated Oct. 23, stated: According to arrangement, I, along with certain members of the Sub-Committee appointed to inquire into the oil-gas process, visited Belfast on Friday, the 12th inst., for the purpose of inspecting the water-gas plant in operation there, which is on the Lowe principle. . . . In the unavoidable absence of Mr. Stelfox, the Engineer, Mr. Sharpe, Assistant Manager, kindly showed the deputation the working of the water-gas apparatus, and explained the method of manufacture. The Committee were highly pleased with all they saw; and to guide the Commissioners in their consideration of the advisability of adopting this process at their works, I beg to submit the undernoted particulars: The rapidity of production is considered a most important feature of the water-gas process, as it can be put in full working order in from 4 to 6 hours; whereas, even with the most improved settings for the manufacture of coal gas, it requires from 24 to 48 hours, according to the material used. The first thing which arrests the attention of one occupied in the manufacture of coal gas, is the small area necessary for the production of a large volume of water gas, and also the cleanliness of the whole process. [Then follows a description of the plant, and a statement of the advantages claimed for the water-gas process.] While I agree that the quantity of sulphur is less per 1000 cubic feet of crude water gas, the quantity of carbonic acid is sure to be greater; and there is always present the very dangerous gas carbon monoxide. When in America a few years ago, I visited the gas-works at Waterbury, where this process is carried out; and I observed that the gas gave a beautiful clear flame. It was also quite permanent; and, in proof of this, no syphons had been pumped for some years. I tested the quality of the gas several times, and found it to average 26·25 candles. [There are then given the results of practical working, as placed before the Incorporated Gas Institute in June last by Mr. Stelfox, bringing out the net cost of water gas at 14·31d. per 1000 cubic feet; and the net cost per pound of sperm at 0·159d.] The Sub-Committee inspected the Dawsholm works of the Glasgow Corporation, and saw the water-gas plant in use there. . . . The installation is on a much smaller scale than that at Belfast; but the Engineer (Mr. Foulis) is well pleased with the results, and mentioned that the cost of 1000 cubic feet of water gas, of 24·50-candle power, in the holder was about 14d. Mr. Wilson, Resident Engineer, expressed his satisfaction with the apparatus, and gave it as his opinion that no gas-works of limited area should be without a plant of this description.

In a second report, dated Feb. 22, 1895, Mr. Mitchell stated: From previous reports by me, descriptions of the two systems under consideration by the Commissioners can be obtained. These systems are the Peebles oil-gas process and the carburetted water-gas method of Messrs. Humphreys and Glasgow. After careful comparison of these two processes, I am prepared to recommend the Commissioners to introduce carburetted water gas, as being the more suitable, and the one from which greater advantages may be derived. Further, the latest adaptation of the Peebles process has not been tried, as far as I am aware, on a large working scale; and Messrs. Humphreys and Glasgow's arrangement has been in operation in a number of important works, giving complete satisfaction. Also, with the last-mentioned plant, owing to its having been thoroughly tested, there would be almost no risk; whereas with the most recent development of the Peebles process, unforeseen defects may be encountered, and these, occurring in a works like that at New Street, might entail serious results. With reference to the expenses which would be incurred in preparing a suitable site, altering existing structures, providing and erecting a water-gas installation of a capacity equal to 2 million cubic feet per day, the following is an approximate estimate:—

Removal of existing retort-bench and fittings . . .	£200
Cost of water-gas plant, including machinery, buildings, gasholder, and oil-tank	12,442
Total probable cost, not including boilers	£12,642

I consider that a water-gas apparatus capable of manufacturing 2 million cubic feet per 24 hours, in conjunction with two sections of Siemens's regenerative bench, would be sufficient to meet the maximum consumption, and would leave a margin, consisting of one section of regenerative bench, in case of emergency. Other processes for the enrichment of coal gas and manufacture of water gas have been devised. Among these may be mentioned the carburetted water-gas method of the Economical Gas Apparatus Construction Company, Limited, of Toronto, represented in this country by Mr. Westcott, and which has already been brought under the notice of the Commissioners. But I do not think that it has been introduced here on any very large scale, or such as to produce reliable working data, though, from published reports, it gives satisfaction where it has been adopted abroad. An amalgamated system of the patents of the Oil-Gas Enrichment Company (who have the monopoly of the Peebles process), has been designed by Messrs. R. and J. Dempster, of Manchester, for the Edinburgh works, the plans for which are now submitted. Having studied these plans, my opinion is that, although the arrangement has many good points to recommend it from a theoretical point of view, I am not aware that it has been carried out on a practical scale; and possibly considerable risk would be involved by its adoption. Mr. Glasgow, of Messrs. Humphreys and Glasgow, has patented quite recently an addition to his previous plant, whereby he hopes to secure enrichment by means of oil in a more economical manner. But it might be considered by some that this invention bears a striking resemblance to part of the Peebles patent. As to its ultimate success, it is hardly possible to speak with certainty; but, should it attain the desired object, a saving in the cost of manufacture would doubtless accrue therefrom.

Appended are the comparative costs of manufacture of coal gas and carburetted water gas (Humphreys and Glasgow's) :—

(1) Coal gas, actual cost for 1893-4 at the Edinburgh works = 20·20d. per 1000 cubic feet in the holder. Illuminating power, 24·91 candles.

Details :—	
Net cost of coal per 1000 cubic feet.	11·63d.
Cost of manufacturing, wages, and charges, including purification	7·29
Repairs, maintenance, and renewals of works and plant	1·28
Total cost per 1000 cubic feet in holder	20·20d.

(2) Carburetted water gas, from working statement at Belfast, per 1000 cubic feet in the holder, 14·31d. Illuminating power, 26·22 candles.

Details :—	
Oil, coke, and wages, per 1000 cubic feet	13·95d.
Water.	0·10
Purification (estimated)	0·50
Wear and tear	0·50
	15·05d.
Less value of tar	0·74
Total cost per 1000 cubic feet in holder	14·31d.

From the above figures, it will be seen that there is a saving of 5·89d. per 1000 cubic feet of gas produced in favour of the carburetted water-gas apparatus.

Mr. F. T. C. Linton, Engineer of the Leith works, in his report, dated Feb. 16, stated as follows :—

Since submitting a report, in April, 1893, on the manufacture of gas from oil, and enriching therewith water gas or gas made from common coal, great advances have been made in improving and perfecting these processes. At that date, the Peebles process held the field. But since then the carburetted water-gas process, as introduced into this country by Messrs. Humphreys and Glasgow, of London, and others, has made rapid progress, and is now largely used in London, Liverpool, Belfast, Glasgow, and other places; and reliable information is available as to its cost, enabling comparison to be made with other methods. Improvements are still going on; and this week a further patent has been taken out by Messrs. Humphreys and Glasgow, which practically adopts what is the special novelty of the Peebles process in the treatment of the oil. In the new process, instead of the oil being brought, as at present, into contact with water gas at a high temperature once for all in the carburettor—with the result that the portion not made into gas (about 15 per cent. of the oil used) is left in the form of oil and condensed steam, which it is not easy to utilize or dispose of—it is now proposed to decompose the oil at a comparatively low temperature, and return the condensable vapours again and again to the carburetter or producer till converted into permanent gas, as in the Peebles process; the residual left being in the form of coke, which is to be utilized for the production of water gas.

The Peebles process has also been adopted in many gas-works in England and Scotland, and is highly spoken of wherever used. With it, also, improvements and alterations have been made, and especially with the view of combining it where desired with the water-gas process. So that both are now practically working on the same lines, and will in the issue probably arrive at a common arrangement of apparatus. Plans and estimates for an installation at the Edinburgh works, to produce 1½ million cubic feet of 25-candle power carburetted water gas, and also to enrich 3¾ million feet of common coal gas from 16 up to 25 candle power—making in all 5¼ million feet per 24 hours—have been sent to the Commissioners by Messrs. R. and J. Dempster, of Manchester; but, in the reporter's opinion, the scheme embodies certain objectionable features, which make it inferior to both of the originals from which the composite arrangement is derived.

No contrast is possible between the latest developments of the two processes, because they only exist on paper, and are not in operation anywhere. It is almost certain that they will give better results than the processes which the Committee have inspected at various places; but it is not possible to give any figures with respect to them derived from actual experience, or to estimate with any exactness what the improvement in results may be. These latter remarks also apply to the carburetted water-gas process of the Economical Gas Apparatus Construction Company, of Toronto, which has lately come into the field, and claims to produce better results than Messrs. Humphreys and Glasgow, but which has not as yet any plant in operation in this country. In making the following comparisons, therefore, only those systems have been dealt with regarding which we have figures derived from actual experience. The gas to be supplied has been taken at the present standard of the Commissioners—viz., 25-candle power.

Dealing first with the capital expenditure involved in each process, the charge per 1000 cubic feet for gas made would be much the same under any of the processes. Taking as a standard plant to make 3 million cubic feet of gas per 24 hours, the cost for coal gas would be about £35,000, which would include all the carbonizing plant and buildings, the condensers, and the scrubbers, and also coal-breaking, drawing, and charging machinery. The combined coal-gas and oil-gas plant would be about the same; and the combined carburetted water-gas and coal-gas plant, about £33,500—there being included in the two latter cases the oil-storage tanks and the relief gasholder and tank, which are necessary for proper working. The charge for working per 1000 cubic feet of gas made, would therefore be about equal; and it is not necessary to take it into account.

Coming now to the cost of making gas, and taking first the cost of making gas from a mixture of cannel and splint coal, we find that the net cost for coal per 1000 cubic feet of gas made was 10·23d. last year in Leith. The average cost for a mixture of cannel and splint to make 25-candle gas is not likely to be much below this, and could not safely be taken at less than 10d. per 1000 feet of gas made. The charge for labour and purification was 7·31d.; but this would not be a fair figure for comparison, as all the work is done by manual labour. A fair proportion would be the probable figure if the work were done by machinery; and that may be taken at 5d. per 1000 feet. Repairs and maintenance cost 1·76d.; but an average figure would be about 2d.

Taking these figures, gives the cost per 1000 feet of 25-candle power gas, delivered into holder, made from mixture of cannel and splint coal :—

Net cost of coal	10d.
Labour and purification	5
Repairs and maintenance	2
	17d.

The cost of a mixture of oil gas (Peebles process) and splint coal gas would be made up as under :—

Oil Gas.

Cost of gas from 1 ton of oil, yielding 22,000 cubic feet of 90-candle power gas :—

One ton of oil (253 gallons, at 2¼d.)	£2	7	5¼
Fuel for retorts (12 cwt., at 7s. per ton)	0	4	3
Labour and purification, at 3d. per 1000 feet	0	5	6
Repairs and maintenance, at 1½d. „	0	2	9
Charge for royalty	0	2	6
	£3	2	5¼
Deduct value of residual coke	0	3	6
Total.	£2	18	11¼

This works out at 32·15d. per 1000 feet of gas made.

One ton of splint coal, yielding 10,000 cubic feet of 14-candle power gas	£0	8	6
Labour and purification, at 5d. per 1000 feet	0	4	2
Repairs and maintenance, at 2d. „	0	1	8
	0	14	4
Deduct saleable coke, 7⅛ cwt., at 7s. per ton (2s. 6d.), and liquid residuals (2s. 8d.)	0	5	2
Total.	£0	9	2

Being 11d. per 1000 cubic feet made.

Mixture of Splint Coal Gas and Oil Gas.

10,000 feet of 14-candle splint gas	=	140,000		
1,700 „ 90 „ oil „	=	153,000		
11,700 feet of 25-candle gas	=	293,000		
Cost of 10,000 feet of splint coal gas, as above			9s.	2·00d.
„ 1,700 „ oil gas			4	6·65
Total			13s.	8·65d.

This works out at 14·07d. per 1000 feet of gas made.

The cost of a mixture of carburetted water gas and splint coal gas would be—

Cost of 1000 cubic feet of carburetted water gas of 36-candle power—	
Oil (6 gallons, at 2¼d.)	13·50d.
Coke and fuel	2·00
Water and sundries	0·25
Labour and purification	2·75
Repairs and maintenance	1·00
	19·50d.
Deduct for liquid residuals	0·50
Cost of 1000 feet of 36-candle gas	19·00d.
„ „ 14-candle splint coal gas, as before	11·00
	30·00d.

This works out at 15d. per 1000 feet of gas made.

The relative costs for 1000 feet of 25-candle power gas, delivered into the gasholders, are therefore—

Mixed cannel and splint coal gas	17·00d.
Mixed splint coal and oil gas	14·07
Mixed splint coal and carburetted water gas	15·00

The cost of making 25-candle gas is at present cheaper by either of the mixed oil and coal processes than gas made from a mixture of cannel and splint coals—even with machine stoking and all other improvements for cheapening manufacture. Were oil to rise considerably in price while coal remained stationary, this difference might, of course, be wiped out, or even be the other way; but there seems little likelihood of any considerable rise in the price of oil. Besides, if oil were to rise, cannel coal would almost certainly rise also, as the main factor in keeping down the price of cannel will no doubt be the fear of competition from oil. It may fairly be taken, therefore, that the difference of cost between gas made by either of the mixed oil and coal processes and gas made from coal only, will, in any probable condition of matters, be nearly as above stated.

The costs of the two oil processes will be differently affected by variations in the prices of oil and splint coal. If the price of oil rises, then the Peebles process will have the advantage, because of the higher duty got by it from the oil. If the price of splint coal rises, then the Humphreys and Glasgow process would have the advantage; having only one-half the mixture from splint, whereas with the Peebles process the proportion is about five-sixths. If both rise, then they would be affected about equally.

So far as cost of manufacture is concerned, the mixed coal gas with oil gas made by the Peebles process is cheapest. But there are other considerations to be taken into account; and the question as to which would be most profitable to adopt, must be answered by a consideration of the special circumstances in each case. In works having ample space, the Peebles process would be preferred as being economically the better of the two, and also because of the objection urged by many against water gas, that it is so largely composed of the deadly poison carbonic oxide. Where space is very limited, however—as is unfortunately the case in the Edinburgh and Leith works—the carburetted water-gas process enables a much greater quantity of gas to be made in a small area; and that may be of so much importance as to neutralize the other objections.

The reporter is of opinion that a combination of the special advantages of the two processes will ultimately be found the best; and as both parties are working towards that end, he thinks the Committee should meanwhile hold their hand, and await the further development of events which must shortly be arrived at.

It seems certain that the Oil-Gas Enrichment Company, who

possess the Peebles process patents, will not allow their patents to be infringed by the latest proposals of Messrs. Humphreys and Glasgow, or they may as well proceed at once to wind up their Company. The outcome will very probably be an amalgamation of the two systems, such as by modifications suited to the special circumstances of each case will make it suitable for all conditions. But should Messrs. Humphreys and Glasgow be able to maintain a right to use that which has hitherto been held to be the special feature of the Peebles process, then this last process of theirs, and not the one hitherto used, would be best for the Committee to adopt. Until it is settled that they can maintain such a right, it would be well for the Committee to defer coming to a decision on the subject.

[As stated in our Scotch Correspondent's "Notes" last week, the Works Committee, before whom these reports were laid, recommended the Commissioners to adopt the views of Mr. Linton; and this course was followed.]

THE EXPLOSION AT THE DALMARNOCK GAS-WORKS, GLASGOW.

Mr. Vernon Harcourt's Report to the Board of Trade.

Our readers may remember that, a short time ago, Mr. A. G. Vernon Harcourt, one of the Metropolitan Gas Referees, conducted an inquiry in Glasgow, on behalf of the Board of Trade, into the circumstances attending an accident which occurred at the Dalmarnock Gas-Works of the Corporation on the morning of the 13th of December, whereby several men were injured. The inquiry, the proceedings at which were reported in the JOURNAL for Feb. 12 (p. 323), was the first to be held in Scotland under the Notice of Accidents Act, 1894. Mr. Harcourt has now made his report, which is accompanied by a transcript of the shorthand notes of the evidence. After describing the preliminaries of the inquiry, which included an inspection of the works in company with the General Manager of the Gas Department (Mr. W. Foulis) and the Manager of the Dalmarnock station (Mr. Manwell), Mr. Harcourt proceeds as follows:—

It appears that on the morning of the 13th of December, 1894, a purifying-box was opened; and when the lid had been lifted and moved on one side, ten men got into the box, which has an area of 35 feet square, and began removing the lime with their shovels from the wooden grids on which it lies—eight working in a line parallel to one side of the box, while two others, ranging in front of this line, drove their shovels downwards through the lime to facilitate the lifting of it by the other men. Each man who had lifted a shovelful of lime emptied it into a railway truck alongside; two other men being employed outside the box in distributing the lime in the trucks so that they might be properly filled.

Each box holds two layers of lime about 7 inches in depth. When the lid is lifted and removed, the gas which remained above the upper layer escapes at once; but the gas enclosed between the two layers and between the lower layer and the bottom of the box only escapes slowly by diffusion until wider openings are made for it as the first portions of lime are removed. The volume of gas thus enclosed, in a box having an area of 35 feet square and a clear depth of about 3½ feet, is nearly 4300 cubic feet; and this gas has to make its escape into the air during the emptying of the box. As the gas escapes, its place is taken by air, which mingling with the remaining gas, forms an explosive or rapidly combustible mixture.

When the men had been working for about ten minutes, and had cleared a space about 6 feet wide along one side of the purifying-box, the escaping gas took fire. There seem to have been two outbursts of flame in rapid succession, but no shock of explosion, the mixture of gas and air not being in the proportions in which combustion is most rapid and the mechanical effect of an explosion occurs. Probably the gas was in more than the explosive proportion except immediately beneath the grids which had been cleared, and the rapid burning, or mild explosion, of gas and air near the opening was followed by a rarefaction and in-draught of air; and this air, mixing with more gas while a portion was still burning, caused the second outburst of flame. All the men who were shovelling in line were burnt more or less where their skin was exposed—none, I am glad to say, very seriously; and they had all recovered, or nearly so, at the time of my visit. The men at each end of the line suffered least; and the two men who were digging in front of the line, and thus were not standing upon the wooden grids but upon the lime itself, escaped contact with the flame.

It was proved that the valve admitting gas to the box was perfectly closed; and therefore the gas, which remained as usual beneath the lime, alone took fire. Although it is possible to get rid of this gas before the main work of shovelling the lime away proceeds, this is not the ordinary practice. I think, therefore, that no blame attaches to the Managers of the works, nor to the foreman, for allowing the men to work with this combustible or explosive mixture of gas and air beneath their feet.

On the questions whether the men were fully informed of the danger they would incur by using a light or striking a match in the purifying-box, and how the gas was ignited, I received much evidence. Both the Managers and the labourers were certain that the ignition of the gas cannot have been due to any use of a light; and that as the men work only in shirt and trousers, a match cannot have been dropped accidentally. All the labourers whom I examined stated that they and their fellows were fully aware of the danger to which they would be exposed by the striking of a light.

It was given in evidence by Mr. W. Paterson, the under-manager of the works, that the emptying of the purifier is very rarely done while it is dark—probably once or twice in the winter time—and that it was dark when the accident occurred. The artificial lighting of the purifying-house is by gas-burners behind panes of glass set in the wall of the building at a considerable height above the boxes. This arrangement is perfectly safe; but the light must be feeble. It naturally suggests itself that on the rare occasions when the work is being done without help from the daylight, the labourers may be tempted to supplement the light by the use of a lantern. But all the witnesses whom I examined on this point stated that such a light was never used in the purifiers; and I think this supposition may be absolutely dismissed.

When foul lime is exposed to the air, its temperature rises, and some steam is given off from such lime when moderately damp, which is more or less visible according to the state of the atmosphere. But there seems no reason to believe that in these circumstances the point of ignition is even approached. Mr. G. R. Hislop, the Manager of the Paisley Gas-Works, said: "Lime will heat but never take fire. That is almost impossible, I should say." R. Ward, a labourer, with eight years' experience in the purifying-house, stated that he had never known the lime take fire or become hot enough to light the gas. Mr. Manwell, who had been the Manager for 23 years, said, in answer to the question whether the lime could have heated so much as to cause the explosion, that he had never heard of such a thing in his experience, and never seen it. The lime became sufficiently warm to steam a little; but nothing beyond that. To this evidence I would further add that, though a large heap of foul lime exposed to the air for many hours may undoubtedly become very hot at some depth from the surface, by the accumulation of the heat due to slow oxidation, neither the oxidation nor the accumulation of heat can take place to any similar extent in a layer 7 inches deep, through which a mixture of air with a large proportion of coal gas has passed slowly for a short time.

I think it certain, therefore, that the ignition of the gas was not due to the heating of the lime. As far as I can see, the only cause of the ignition of the gas still remaining is that suggested by Mr. Foulis and most of the other witnesses—namely, the striking of a spark by a labourer's shovel.

Here two questions arise—first, whether it is likely that sparks may be struck in the operation of shovelling out the lime; and, secondly, whether such sparks would light the gas. As these two questions are of much importance, I extract here the evidence I received in relation to them.

Mr. *W. Paterson*, Under-Manager.

(*Q.*) Have you formed any opinion as to how the gas came to take fire?—(*A.*) The only opinion I have formed is that one of the shovels striking on a small stone had caused a spark, and this ignited it. This is the only thing I can see. (*Q.*) Have you ever known gas to be fired by such a cause as you assign?—(*A.*) No, never in all my experience.

Mr. *G. R. Hislop*, Manager of the Paisley Works.

(*Q.*) Have you formed any opinion as to how the gas was lighted on this occasion?—(*A.*) Only by the striking of the steel shovel on a flint or on the edge of the box. * * * In either case it might cause it. The thing may have taken place without the men observing how it occurred. (*Q.*) Have you known a case of gas being ignited in that way?—(*A.*) I can fancy it happening, and I should say that it has occurred. (*Q.*) Can you remember any case?—(*A.*) I do not know that I have made the experiment, but I would have no hesitation in saying that it could be done; it would depend upon the strength or explosive character of it. It might happen at the moment when the mixture was highly explosive; and this would favour an explosion. (*Q.*) Can you say if you have seen it?—(*A.*) I cannot say definitely that I have; but I would say that it was a natural thing to expect.

C. M'Allister, Labourer.

(*Q.*) In shovelling the lime, have you ever known your shovel to strike against anything harder than the lime, compact, as it becomes, by the action of the gas?—(*A.*) Yes; I have felt it striking against a stone many a time. (*Q.*) Have you ever looked at one to know whether it was flint or limestone?—(*A.*) It is generally flint which comes out of the kiln. (*Q.*) But flint which has been heated by the kiln and so changed and broken up?—(*A.*) Some of it broken up, and some of it not.

H. Fullarton, Labourer.

(*Q.*) Do you remember ever seeing a spark struck with a shovel?—(*A.*) Yes. (*Q.*) Through a shovel striking against something?—(*A.*) Yes. (*Q.*) You have seen such a spark?—(*A.*) Yes. (*Q.*) Evidently by a shovel striking a stone?—(*A.*) Yes; it struck against a stone, and there was like a wee spark, and there was a fizz. (*Q.*) Is that what you have seen?—(*A.*) What I have seen. (*Q.*) Have you seen a spark by striking against the side of the iron box?—(*A.*) Not often.

R. Ward, Labourer.

(*Q.*) Have you ever seen sparks caused by what you do in picking up the lime or throwing it into the waggons?—(*A.*) I have seen a spark caused by striking the iron side of the purifier. (*Q.*) Would that be when lime was being thrown out of the iron box?—(*A.*) Yes, when you are knocking a shovel, and striking the edge of the tank, it will make a spark. (*Q.*) In breaking up the lime into pieces suitable for lifting, you have seen a spark?—(*A.*) Yes. (*Q.*) Have you seen sparks caused in any other way?—(*A.*) No. (*Q.*) Not by a stone?—(*A.*) No; but I have seen it against the side.

The evidence here given seems to prove that sparks are sometimes struck by the labourers' shovels coming in contact with the sides of the iron box or with stones in the lime. On the second question—whether such sparks can light a mixture of gas and air—there is little but conjecture. While the smallest electric spark will light a jet of gas, a stream of sparks from flint and steel will not do so. The use, at one time, of the steel-mill for lighting coal mines proves that the similar mixture of marsh gas and air is not inflamed by sparks struck from steel in an apparatus constructed to produce a number of brilliant sparks. But these sparks, which consist mainly of particles of iron incandescent and burning in the air, may vary greatly in size and in intensity. A very light tap of a hammer on a flintstone, or of two files, one against another, produces sparks, but the particles of iron thus knocked off must be very minute; but where more force is put into the blow, the particles of incandescent iron may be much larger. A horse striking his shoes one against another sometimes produces sparks which are very vivid, and continue to glow for perhaps one or two seconds. A labourer using a shovel with his full strength, and chancing to strike against a flint or a plate of iron, might occasionally produce a similar spark. When an iron wire is heated in a bottle containing an explosive mixture of air and coal gas, by passing through it an increasing current of electricity, the gas inflames when the iron has reached full red heat. The same gaseous mixture may be inflamed by an iron rod heated to redness in an ordinary fire. In view of these

facts, I think it possible a mixture of gas and air might be inflamed by a particle of iron struck off by a heavy blow.

It is, however, exceedingly unlikely that such a blow should be struck in shovelling out lime, for the men do not need to dash their shovels into the lime; and the impact against a stone in the lime would be deadened by the stone not being firmly fixed, and both it and the shovel being covered with lime. It seems also unlikely, from the evidence in this case, that any shovel struck violently against the side of the box. But the liability of coal gas to be ignited by a spark is greatly increased by the presence of sulphur compounds. Two such compounds are formed when foul lime is exposed to the air—sulphuretted hydrogen and bisulphide of carbon.

Since gunpowder is easily ignited by a spark from flint and steel, and the ignition probably begins by the inflammation of a minute particle of sulphur, I thought it possible that the sulphur which is present in foul lime might be inflamed by a spark, and then set fire to the gas. I obtained some foul lime, and mixed it with an additional quantity of flowers of sulphur. Placing this material on a perforated tray, I sent up through it a mixture of gas and air, and over it struck sparks with a flint and hammer and with two files, many of which fell into the tray; but the gas did not light. I then let fall on the material here and there a few drops of bisulphide of carbon. Again striking sparks, I twice succeeded in lighting the mixture of gas and air after this addition. I then tried whether sulphuretted hydrogen could be lit by sparks from flint and steel; and, after a few trials, I succeeded in lighting it. I conclude, therefore, that the cause of the ignition of the gas suggested by Mr. Foulis and others is a possible cause, and was the actual cause, though the concurrence of the conditions under which gas can be thus ignited is so rare that none of the witnesses knew of such a thing having happened before.

Similar purifiers are emptied in a similar manner all over the country, at the average rate of some hundreds daily; and accidents from the ignition of the gas are almost unknown. If, however, the spark which may now and then light the gas is caused by a shovel striking a flint stone, and if, either from the limestone used or from special care taken to remove stones, flints are not often present in the lime, the risk may be exceptionally great in the Glasgow works, and wherever else the same limestone and system are used. The particular stone found in the lime after the accident, and sent to the Procurator Fiscal, by whom it was lent to me, was a perfectly harmless piece of limestone, which could be scratched by the nail, and was incapable of yielding a spark under conditions in which sparks were readily struck from pieces of flint and quartzite of the same size. But I was shown at the mouth of the kiln a piece of flint or chert of the size of a cricket ball; and though it is not likely but that a stone as large as this would be picked out and thrown aside in preparing the lime, it is quite likely that smaller flints escape removal.

I come now to the question whether any precautions beyond those already taken are possible, and should be taken, to prevent the recurrence of a similar accident. What is needed is that either the striking of sparks in shovelling out the lime should be prevented, or that the gas beneath the layer of lime should be got rid of before the shovelling proceeds.

The striking of a spark cannot be made impossible, but its frequency might be further reduced by various precautions, some of which have been suggested to me. The screening of the lime would probably be an unduly burdensome precaution; but perhaps more care might be used in picking out the stones. Strips of copper might be riveted along the ends of the shovels, if it is found that this metal will bear for long enough the rough work and the contact with foul lime. Light boarding might be placed against the side of the box over which the lime was being discharged.

To get rid of the gas from beneath the lime before shovelling the lime out, seems to me both simpler and more certainly effectual. Since the accident, this has been done. When I was shown the emptying of a purifier at the Dalmarnock works, I noticed that two grids had been lifted out at each of two opposite corners of the box, and also one or more grids from the lower tier. I suggested that if this were done as soon as the lid was clear, and an interval of ten minutes were then allowed before the gang of men entered the box, the work would be perfectly safe, for nearly all the gas would have escaped. I was told that this had been done, and that they had allowed a quarter of an hour for the escape of the gas through the openings before the men set to work.

No better plan, I think, could be followed; and I therefore recommend its continuance at the Dalmarnock Gas-Works, and, if I may venture to do so, its adoption at other works where it is possible that flint stones may be lurking among the lime used for purification. I believe that the rate of escape of the enclosed gas when two clear openings of such an area as 4 or 5 square feet are provided at opposite corners of the covering of lime—one for the gas to ascend, and the other for the air to descend—would be very rapid as compared with its slow escape through grids which are still half choked with lime. The difference is like that between the effectiveness of an open window and of a ventilator of wire gauze or perforated zinc.

Although, in view of the accident which has occurred, the precaution taken by Mr. Foulis is clearly wise, the cause of the accident appears to be unprecedented. I agree with the statement given in evidence by Mr. Hislop: "The usual precautions were taken; and I think such an accident might happen to-day, and it might not happen again during the next fifty years." I find, therefore, that the accident was not due to any act or default or negligence of the Managers of the works or of any person in their employment.

The Merthyr Tydfil Water Bill.—A public meeting of the ratepayers of Merthyr was held yesterday week, to consider the clause dealing with the charges for water in this Bill, which is being promoted in Parliament by the District Council. A resolution was unanimously carried, to the effect that the meeting, having further considered the provisions of the Bill, offered its most determined opposition to the clause in question, which was regarded as unfair and unjust to the general body of ratepayers. The proposed increase of the charges was described as "a dastardly attempt to impose fresh burdens on the people."

EAST LONDON WATER COMPANY.

Half-Yearly Report and Accounts.

In their report to be presented at the half-yearly general meeting of this Company next Thursday, the Directors state that the revenue in the six months ending Dec. 25 last amounted to £158,555, as compared with £157,587 in the corresponding period of 1893; being an increase of £968. The expenditure was £62,193, against £63,038—a decrease of £845. The Directors point out that the increase in the revenue is small; but that for the corresponding period of 1893, with which it is compared, was abnormally high, while the wet season of the past half year greatly reduced the charges for road watering. The average increase, spread over three years, shows favourably. The extensions of works, machinery, and mains are proceeding with all despatch, and most satisfactorily; and the whole of the plant is in excellent condition. The quantity of water pumped was 8,037,355,225 gallons, all of which has been certified by the Government Official, as well as by the Analysts acting on behalf of the Water Companies, to have been pure and well filtered. The new services laid on numbered 2253, against 2078 in 1893. The total number is now 180,084. Reference is made to the Water Bills introduced by the London County Council, which, of course, are receiving the close and earnest attention of the Directors. Tenders for £100,000 of 3 per cent. debenture stock (part of the £500,000 stock created at the special general meeting held on Oct. 4, 1894) were received on the 13th of December last. The sum was allotted at an average price of £103 16s. 2d.; the amount tendered for being upwards of a million sterling. The Directors recommend a dividend on the ordinary stock at the rate of 8 per cent. per annum (less income-tax). This will absorb £68,780; leaving an unappropriated balance of £18,060.

PROPOSED PURCHASE OF THE NORWICH WATER-WORKS BY THE TOWN COUNCIL.

The Norwich Town Council have resolved to look again into the question of purchasing the water-works. The matter was brought before them at their last meeting by Mr. Jenkinson, who moved—"That the Law and Parliamentary Committee be requested to consider as to the prospects of a Bill if promoted by the Corporation for the compulsory purchase by the Corporation of the Norwich Water-Works, and to report thereon to the Council." In support of the resolution, he pointed out that if the Corporation owned the water-works, the profits earned by the supply of water might go towards diminishing the rates. The fact that the water-works belonged to a Company put, he said, great difficulties in the way of the Corporation when carrying out street-paving, &c.; and he gave as the principal reason for bringing the question forward at the present time the numerous complaints by ratepayers as to the supply of water being cut off during the late frost. He was sure, had the water-works been in the hands of the Corporation, means would have been taken to get water into the homes of all the people. This had been done in other towns; and what was accomplished elsewhere, ought to be possible in Norwich. Mr. Wild, while agreeing that local authorities should have possession of the water-works, reminded the members that the Corporation had failed to get the supply of water in their hands by arbitration; and he desired to know how they could obtain control of it. Mr. Jenkinson replied that, in going through the correspondence between the Secretary to the Company and the Town Clerk, he found that much was made of the unfailing manner in which the Company had for 40 years discharged their duties to the citizens. But recently they had in the most shameful way distinctly failed to do their duty. The resolution was seconded by Mr. Noble. Mr. Hackblock stated that two points arose when the question was previously raised. In the first place, it was obvious to the Council that it was impossible to purchase the works at a price that would not entail on the present generation a large increase in the shape of rates. It was all very well for a local authority who had bought works long ago, and had the benefit of the enlargement of the boundaries, with an increase of population. But the Committee felt they had gone to the outside price at which it would pay them to purchase; and the offer they made was ridiculed by the Company and their advisers. The Counsel consulted by the Committee were unable to find a single case where Parliament had passed a Bill allowing a local authority to buy up water-works without the company's consent. They were advised that, whatever they might recommend to the Council for the bringing in a Bill of that sort, would be simply waste of money. No doubt the case of London was being tried tentatively; and the experiment would be carefully watched. One of the interesting points would be on what terms it was to be done, and whether they could be applied to Norwich. But until there was a purchase of water-works by a local authority under compulsory powers to guide them, it would be unwise on their part to spend money in promoting a Bill. Dr. Gallard thought that, considering the supply was not above suspicion, it would not be advisable to entertain the proposition. He moved an amendment to that effect. Mr. White was of opinion that there had been some slight changes in the circumstances, which made it worth while to have this matter re-investigated. The motion was then agreed to.

The Recent Suffocation by Gas at North Kensington.—Last Tuesday, Mr. C. L. Drew held an inquiry, at the Kensington Town Hall, into the circumstances attending the death of George John Swain, aged 18 years, a watchmaker's assistant, of Golborne Road, North Kensington, who, with his two brothers, aged 10 and 12 respectively, was found insensible in his bedroom on the morning of the 23rd ult., as recorded in the JOURNAL last week. There had been an escape of gas. The lads were foaming at the mouth when found; and the eldest died half an hour later. The other two recovered. Mr. A. Vincent said that, in his opinion, the accident was caused by the chains of the chandelier being too long, allowing it to slip too low. The jury returned a verdict of "Accidental death."

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company, which, with the accounts for the half year to Dec. 31 last, will be presented at the ordinary meeting of the proprietors next Thursday:—

The Directors submit the accounts for the half year ended Dec. 31, 1894. The revenue account shows a net profit for the half year of £49,466 16s. 8d.; making, with £840 18s. 9d. received for interest, £50,307 15s. 5d. This, added to the amount brought forward from the previous half year, makes £74,806 6s. 4d. Deducting therefrom £3712 10s. for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £71,093 16s. 4d. available for dividend. The Directors recommend the payment of dividends at the rates of 13½ per cent. per annum upon the old stock of the Company, and of 10½ per cent. per annum upon the new stock, both less income-tax. Having regard to the price charged for gas during the year, a balance equal to ¼ per cent. per annum available for dividend remains to be dealt with; and the Directors recommend that this balance be carried to the reserve fund. The balance of the net revenue will be carried forward to the next half year. The Directors have appointed Mr. Frederick Green a Director of the Company in the place of Mr. Hammack, deceased. The following Directors—Sir John Colomb, K.C.M.G., and Mr. Pilcher—retire by rotation; and, being eligible, offer themselves for re-election. Mr. G. Ilsley, one of the Auditors, will also go out of office by rotation; and, being eligible, offers himself for re-election.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as before—viz., £715,000 paid up, out of a total of £830,000 authorized. The statement of loan capital (No. 2) is also unchanged—£165,000 borrowed, out of £300,000 authorized. The capital account (No. 3) shows receipts to the amount of £880,000, out of which a total of £863,477 had been spent up to June 30 last, increased to £866,092 by the expenditure of £2615 (of which £2167 was for new coin meters and fixing) in the six months covered by the report. The unexpended balance at the close of the year was £13,908. The remaining statements in the accounts are reproduced in full.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—		
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£65,341 16 0			Common gas, per meter, at 2s. 7d. per 1000 cubic feet	£124,077 14 11	
Salaries of Engineers, Superintendents, and other Officers at works	2,197 0 0			Public lighting and under contracts, common gas	9,459 2 11	
Wages (carbonizing)	18,381 4 10			(See statement No. 10.)		£133,536 17 10
Purification, including £1890 7s. 9d. for labour	4,130 12 2			Meter-rental	£2,051 7 7	
Repairs and maintenance of plant and works, materials and labour (less £314 11s. 9d. received for old materials)	20,244 14 7			Stove-rental	902 15 8	
		£110,285 7 7		Coin meters and fittings	278 1 0	
Distribution of gas—						3,232 4 8
Salaries and wages of Officers (including Rental Clerks)	£1,894 4 3			Residual products—		
Repairs, maintenance, and renewals of mains, service-pipes, and fittings, including labour	3,512 15 2			Coke, less £3379 6s. 3d. for labour	£28,186 16 1	
Repairs and renewals of meters	1,705 5 10			Breeze, less £465 13s. 8d. for do.	633 18 3	
„ „ stoves	976 6 7			Tar	8,620 2 6	
„ coin meters and fittings	232 5 6			Ammoniacal liquor and sulphate	8,778 2 11	
		7,820 17 4				46,213 19 9
Public lamps—				Miscellaneous receipts—		
Lighting and repairing		2,358 0 0		Rents	£220 7 8	
Rent, rates, and taxes		6,371 4 1		Transfer fees	19 2 6	
Management—						239 10 2
Directors' allowance	£1,250 0 0					
Company's Auditors	75 0 0					
Salaries of Secretary, Accountant, and Clerks	1,131 4 0					
Collectors' salaries and commission	1,503 7 11					
Stationery and printing	509 6 2					
General charges	384 9 9					
		4,853 7 10				
Bad debts		975 1 4				
Law and parliamentary charges		419 9 9				
Superannuations		600 0 0				
Official Officers		72 7 5				
		£133,755 15 4				
Balance carried to profit and loss net revenue account (No. 5)		49,466 16 8				
		£183,222 12 0				£183,222 12 0

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£3,712 10 0	Balance, June 30, 1894	£68,498 10 11
Balance available for dividend, carried to balance-sheet	71,093 16 4	Less—Amount of dividend paid for half year ending June 30, 1894	44,000 0 0
			£24,498 10 11
		Balance from revenue account (No. 4)	49,466 16 8
		Dividends and interest balance	840 18 9
	£74,806 6 4		£74,806 6 4

No. 6.—RESERVE FUND.

Balance on Dec. 31, 1894	£38,014 14 6	Balance on June 30, 1894	£38,014 14 6
	£38,014 14 6		£38,014 14 6

No. 7.—INSURANCE FUND.

Balance on Dec. 31, 1894	£28,652 7 7	Balance on June 30, 1894	£28,652 7 7
	£28,652 7 7		£28,652 7 7

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1894.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, Dec. 31, 1894.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	43,585	107,981	107,712	150	43,704
Cannel	2,569	590	42*	—	3,117
	46,154	108,571	107,754	150	46,821

* 167,498 gallons of petroleum spirit (lower grade) used as a substitute for cannel.

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1894.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, Dec. 31, 1894.
Coke—tons	350	65,717	17,388	48,035	5,644
Breeze—do.	250	9,790	2,500	6,090	1,450
Tar—gallons	137,700	1,067,703	—	1,006,943	218,460
Ammon. liq.—butts of 108 gals.	6,279	35,062	28,370	—	12,971
Sulphate of ammonia—tons	428[5]	913[15]	—	200	1,142

No. 10.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,115,907	59,543	960,602	1,020,145	14,841	1,034,986	80,921	5,419

BALANCE-SHEET.

To Capital—		By Cash at Bankers	£5,142 1 1
For balance, per account No. 3	£13,908 3 6	Cash in hand for current expenditure	3,000 0 0
Net Revenue—		Amount invested in Consols	66,667 2 1
For balance, per account No. 5	71,093 16 4	Stores in hand—	
Reserve Fund—		Coals	£28,592 1 0
For balance, per account No. 6	38,014 14 6	Coke and breeze	3,424 12 0
Insurance Fund—		Ammoniacal liquor and tar	17,509 7 2
For balance, per account No. 7	28,652 7 7	Sundries	7,884 4 10
Dividends outstanding	2,061 2 9		57,410 5 0
Deposits	9,565 19 2	Accounts due to the Company—	
Interest on debenture stock	223 15 0	Gas-rental, quarter ending Dec. 31, 1894	£80,980 6 4
Sundry tradesmen and others, for amount due for coals, stores, and sundries	26,987 2 6	Arrears outstanding	844 15 11
Loan from bankers	35,000 0 0		81,825 2 3
		For coke and other residual products	£10,258 19 2
		Sundries	203 11 9
			10,462 10 11
	£225,507 1 4		£225,507 1

ELECTRIC LIGHTING NOTES.

In the JOURNAL for the 8th of January, we referred to the poll which had been taken in Adelaide, South Australia, on the question of substituting electric lighting for gas in the public thoroughfares. It may be remembered that a prominent member of the City Council, now deceased, who had formerly been officially connected with the South Australian Gas Company, had been stirring up the Council to adopt the electric light; and the matter was referred to a Committee, who thought the question should be settled by a poll. This was accordingly taken on Dec. 1, 1894. The ratepayers were requested to vote on these two questions: (1) "Are you in favour of lighting the city street-lamps with electricity at present?" (2) "Are you in favour of continuing the lighting of the city street-lamps with gas?" The poll was taken in the six wards into which the city is divided; and in every one the result was in favour of gas. The numbers were: Gas, 3382; electricity, 2255—majority, 1127. There were about 500 informal papers, most of which were returned blank or filled up with facetious remarks. The large number of ratepayers who answered the questions showed how interested the citizens were in the subject. This may, we think, be fairly attributed in a large degree to the steps taken by the Directors of the Gas Company to retain their hold on the public lighting. The prime mover in the agitation (the late Mr. George Anderson) had made a tour of the world, and had returned to Adelaide with a "mission" to introduce electric lighting. While on his travels, he "reported progress" in the form of a series of letters, which were printed in pamphlet form, and also as an appendix to the report of the Mayor for the year 1892-3 (Mr. C. Wilcox), who gave them the support of his high authority. But there were other people besides Mr. Anderson who could talk about electric lighting, and who, moreover, were for many reasons better qualified than he to recognize its defects, and to appreciate the merits and the claims of gas as an illuminant. The South Australian Gas Company possessed in their Secretary (Mr. J. Evans) an officer who was determined that the interests of the undertaking should not suffer if he could help it. He also, at considerable trouble, prepared a pamphlet on the cost of the electric light, its dangers and disadvantages, failures, losses, and abandonments; and there cannot be the smallest doubt that the printing and distribution of this *brochure* contributed in a very great degree to the upsetting of the electric lighting scheme in Adelaide. In fact, its effects were even more far-reaching; for we believe that copies of it were circulated in Geelong (Victoria), where an electric lighting project was on foot, with the result that the matter was dropped. To return to Adelaide, we learn that the Gas Company have now agreed with the Corporation to light the street-lamps under contract for four years; and we are sure the citizens will not have cause to regret their expression of confidence in the old and well-tried system.

The Hanley Town Council during last year derived a profit of £658 from their electric lighting undertaking—the receipts having been £1574, and the expenditure £916. Of the profit, £627 has been appropriated for interest, and £31 for the reserve fund. The Council have agreed to accept a tender of Messrs. S. Z. de Ferranti, Limited, for generating machinery, for £4036, and to apply to the Local Government Board for sanction to borrow £5000.

In the notice of the intended applications to Parliament in the present session which appeared in the JOURNAL for Dec. 4 last, reference was made to the Bill to be promoted by the Bray (Ireland) Township Commissioners to enable them, among other things, to acquire the electric light works established in that locality by Messrs. J. E. H. Gordon and Co., Limited, and to carry on and extend them. The Bill was opposed by the Dublin, Wicklow, and Wexford Railway Company, and was referred to Sir J. Kitson's Committee. When it came under consideration a few days ago, Mr. Hopwood, of the Board of Trade, attended to make a statement of the views of the Board with regard to the application of the promoters for electric lighting powers by means of a Bill rather than by the usual process of a Provisional Order. He questioned whether it would be well to have, he would not say dual control, but dual procedure. He said the Board of Trade fully recognized that, so far as the present Bill was concerned, there were exceptional circumstances. If the Committee also saw fit to recognize them, he would ask them to impose the obligation on the promoters of making their Bill, so far as the electric lighting provisions were concerned, as nearly as possible, identical with the Board of Trade Model Order. Mr. Littler, Q.C., on behalf of the Commissioners, expressed anxiety to comply with that suggestion. Mr. Hopwood then asked the Committee, if they came to the conclusion that the special circumstances justified the Bill, to say that it must not be treated as a precedent. Mr. Littler thereupon reiterated that the Commissioners were most desirous of complying with the requirements of the Board of Trade; and if Mr. Hopwood would favour them with a short interview, he had no doubt they would be able to agree as to the form which the electric lighting clauses of the Bill should take. If they found there was any serious difference between them, they must refer the point to the Committee; but he did not anticipate any such difficulty. Evidence was then given by the Town Clerk (Mr. P. M'Donnell), who stated that the Commissioners proposed to borrow £6000 for electric lighting; and that even if the consumption remained as at present, a profit of £500 a year would be realized. He added that the acquisition of the electric light undertaking by the Commissioners had already been approved almost unanimously by the ratepayers. Some objection was raised by Mr. Pembroke Stephens, on behalf of the Railway Company, that the clauses in the Bill for their protection, in regard to the electric lighting cables passing under their level crossing, were not adequate. Mr. Littler, however, reiterated the readiness of the promoters to meet any suggestions the Board of Trade might choose to insert in the clauses; and the Committee passed the Bill. They subsequently presented to the House a special report embodying the views expressed by the representatives of the Board of Trade.

Our readers may remember that a fatality occurred a short time ago at the electric lighting works of the Bristol Corporation; the victim being a man named Coleman (see *ante.*, pp. 499, 552). The matter was investigated by Major Cardew, who has now presented his report thereon to the Board of Trade. He attributes the accident, in the first place, to the carelessness of the man who was killed; but such carelessness on the part of uneducated men, when constantly dealing with electrically-charged metal, is, he says, very natural, and should be provided against by all possible safeguards. He continues: "In this case, I cannot say that proper forethought had been shown. The metal terminals and fuses were so placed as to be easily touched; and the man was required to attend to their condition while they were charged. The only precaution adopted was a verbal order that only one hand, protected with an india-rubber glove, was to be used. Granting that the duty was one which was absolutely essential, much greater safety would be secured by providing that the man should wear india-rubber gloves on both hands, and india-rubber shoes; by making the floor of insulating material, such as asphalte; and by placing a guard of vulcanite round the exposed terminals. I cannot see, however, that the exposure of the high-pressure terminals and fuses in this case is at all essential. It is a very common arrangement to enclose these within the iron casing of the transformer; and when so arranged, they can be left for months without examination. In this case, the pressure would be switched off at the central station before sending a man to make an examination of the fuses and fittings within the casing. I strongly recommend that this arrangement should be carried out, at any rate until suitable apparatus has been provided. Another matter to which I drew the attention of the Electrical Engineer, and which I consider calls for remark, is the danger involved in the design and position of the high-pressure fuses on the switchboard at the generating stations, which are such as to make it inconvenient, and even difficult, to take out a fuse without touching metal charged to 2000 volts. It may be necessary, but it is certainly inconvenient, to have exposed metal charged to high pressure on these switchboards; and the danger is to some extent reduced by the fact that the floor is of wood, and generally thoroughly dry; but the safety of the employees should be carefully considered in the design and position of the apparatus." The Electric Lighting Committee of the Bristol Corporation have considered the report, and are taking steps to supply the safeguards indicated by the Inspector. They, however, point out that the arrangements of their stations and sub-stations were under the supervision of their Consulting Engineers, on whose judgment they naturally relied.

A further sum of £5000 was voted by the Hampstead Vestry last Thursday for the extension of private electric lighting in the parish. After the recent *exposé* regarding the arc lamps in the Finchley Road (see *ante*, p. 606), it is not surprising that the Electric Lighting Committee are proceeding more warily than before. Certain memorialists residing in the High Road, Kilburn, have petitioned for the extension of the system to that thoroughfare—the dividing-line between Hampstead and Willesden; but the Vestry decided not to bind themselves in any way until the Willesden District Council have expressed their willingness to pay half the cost of laying the mains and erecting 24 arc lamps, and subsequently half the cost of maintenance. The Engineer's estimate for the former is £1460; and each of the 24 arc lamps will cost £41 per annum at the present price of the current. Before these decisions were arrived at, a member raised the question as to the legality of the proposed action of the Vestry in supplying current for the benefit of any parish other than their own. It was explained that the standards would be erected in the middle of the road, and the mains would remain within the Hampstead boundary. This explanation was not deemed satisfactory; and the discussion leaves the matter still in doubt.

ENGLISH AND GERMAN COMPETITION FOR GAS COAL CONTRACTS.

In the commercial intelligence in the *Newcastle Chronicle* last Wednesday appeared the following paragraph: "The settlement of the gas coal contract for Rotterdam is one which is usually of interest, because of the keen competition with Germany for it. This year, the German Syndicate attempted to secure the whole of the contract, and actually secured about two-thirds of it. The contract is for a little over 72,000 tons in the year. It used to be entirely given to Durham collieries. But last year one-third went to the German pits, this year two-thirds; though there were offers of English coal at from 10s. 3½d. per ton, which is equal to a price here much below the combination rate. The loss of so much of the contract is a loss of trade that is due to two factors. The German Syndicate is devoting all its energies to enlarge its foreign sale of coal; whilst the Durham Sales Association is merely trying, by combination, to keep up prices. It is tolerably clear that there is great difference between the two organizations; and the effect is seen in the fact that, since the combination was formed in Durham, first one-third and then two-thirds of this contract have been lost to the trade here. Our coal is admittedly better gas coal than the German coal; it is near to the seaboard with its cheap carriage; and it ought to be delivered into Rotterdam as cheap as the German, which has to be brought a long way by land—a more costly mode of carriage than by sea. If our coalowners wish to retain the markets for coal they have long had, they will have to meet an international competition that is very keen, and that may be keener; and instead of trying to bolster up prices, they would do well to turn their attention to the questions of cheaper production and cheaper transit It is in these directions that they will find the greater aid to retaining contracts, and not in that of mere attempts to bolster up prices. In some markets, they have a practical monopoly; but in others they have not. If they force up prices, they are in danger of losing the latter, as the result of the Rotterdam tenders show. And there are other contracts to which the lesson taught might be well applied; for in the present day, the forcing-up of prices means in the end the losing of some part of the trade. The revision of cost should be along the whole line; and it would tend to the still further increase of our coal and shipping trades."

Reduction in Price.—The Directors of the Radcliffe and Pilkington Gas Company have reduced the price of gas, which is now from 3s. 2d. to 3s. 8d. per 1000 cubic feet net.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Further acquaintance with the reports of Mr. Mitchell and Mr. Linton to the Edinburgh and Leith Gas Commission on the subject of oil gas (which are referred to in another column), reveals features which I cannot help but notice. In the first place, Mr. Mitchell is struck by the rapidity with which water-gas plant can be put in full working order, and by the small area which it occupies; but he does not observe that these two qualities are both possessed by the latest adaptation of the Peebles process. In the next place, he sets aside the new Peebles process because it has not been tried on a large scale, and unforeseen defects might be encountered with it; and he recommends the adoption of a water-gas plant which has been tried, and has given complete satisfaction. But then the patentee of the water-gas process has, too, brought out a recent modification of his plant, regarding the ultimate success of which "it is hardly possible to speak with certainty; but should it attain the desired object," &c. I should think—and the last clause I have quoted shows that Mr. Mitchell is of the same opinion—that there is as much likelihood of unforeseen defects in the improved water-gas plant, "which might be considered by some" to bear "a striking resemblance to part of the Peebles patent," as there is in the case of the Peebles process itself. Though Mr. Mitchell does not make it plain, it comes to this, then—that he recommends the adoption of plant which, if not afterwards modified, would be at once old-fashioned, but if modified, would cost something to do it. Of course, the prospect he had before him would be that of litigation between the holders of the two patents, with the result that if Mr. Glasgow's patent should be invalidated, he would still have the water-gas plant to work with; whereas, if it should be upheld, the plant might be modified at comparatively slight cost. Whereas, on the other hand, if he were to adopt the Peebles process, and it were invalidated, he might have to throw the whole thing out. The probability of litigation undoubtedly presented a difficult problem. Mr. Linton got over it by recommending the Commissioners to defer coming to a decision on the subject. The ground of his recommendation was that there would "very probably be an amalgamation of the two systems;" and he seemed to think that Mr. Glasgow's patent might be the one they ought to adopt—subject always to Mr. Glasgow being "able to maintain a right to use that which has hitherto been counted the special feature of the Peebles process." The feeling would seem to be that there is a possibility of Mr. W. Young losing the right to exclusive use of the fractional distillation method of treating oils to produce gas. This is a result which I personally should regret, because Mr. Young was undoubtedly the inventor of the system. Into the merits, however, I cannot go. I am dealing with the Edinburgh and Leith Gas Commissioners' doings; and I cannot say that they have treated Mr. Young with much consideration. The history of the matter is that the Commissioners resolved to introduce the Peebles process, and authorized an installation in the Edinburgh works. This was an installation upon the first patent. Just then, however, Mr. Young, with a candour which is rare among men in like situations, informed them that he was bringing out an improved plant for the application of the same principle. The plans for the installation were at once off; and the Commissioners having been applied to by other patentees, made inquiry into their methods of working, with the result that the affections of the Commissioners have been transferred from Mr. Young to the newcomers. Had it not been for Mr. Young's honesty, the Commissioners would to-day be working a plant by his first method, and would have been in a much worse position than he offered to put them by his second method. My feeling is that a sense of gratitude ought to have led the Commissioners to look more favourably upon Mr. Young's process than upon any other. It has not been worked on a large scale; and they are frightened to adopt it, because it may have unforeseen defects. This is not the way that advance is made in gas or any other works. Somebody must introduce improvements; and in this instance, who should more naturally have given favourable consideration to Mr. Young's process than the Edinburgh and Leith Gas Commissioners, who had been so favoured by him? The cost of erecting an experimental plant would have been but a trifle to the Commissioners; and it would soon have repaid itself in working. My opinion, therefore, is that, seeing Messrs. Humphreys and Glasgow's water-gas plant was being given a trial in Glasgow, the Edinburgh and Leith Commissioners might have done the same with the new Peebles process; and then both methods of working could have been judged upon their merits. As it is, it looks as if Mr. Young's process were to be left out in the cold because of the lack of enterprise. If there is any difficulty with regard to the patents, I still think the Edinburgh and Leith Commissioners might have done worse, while waiting for the settlement of the question, than to have gone on with their original plant under the first patent. Having said this with reference to the doings of the Commissioners, I should just like to add, out of my own head—having nothing else to proceed upon—that if the Commissioners have shown a lack of enterprise in the matter, I hope the Oil-Gas Enrichment Company, who, as readers of the JOURNAL are aware, own the Peebles patents, will, if they get the opportunity, show a readiness, by offering easy terms, to encourage the owners of some large gas-works to introduce their system.

The Falkirk Gas Commission do nothing by halves. They are again in litigation with the Falkirk Joint-Stock Gas Company, this time over the fee paid by the Company for revising the deed of conveyance by the Company in favour of the Commissioners. The Lands Clauses Act, under which the transfer of the gas undertaking was carried through, requires that, in the event of the parties not being able to agree upon any question of expenses, it should be referred to the Junior Judge in the Court of Session. This has been done. The amount in dispute is said to be several hundred pounds. On Monday night, the Commissioners approved of the action of their Finance Committee in taking the matter into Court. The Commissioners had also before them a report by their Works Committee, recommending that they should introduce Mr. G. R. Hislop's regenerative system of firing into the works, the estimate for which amounted to £2464; but that they should reserve the question of introducing the Peebles oil-gas enrichment process for future consideration. The caution of the Committee was remarkable; and it was not approved. A number of the Commissioners expressed themselves in favour of both improvements being introduced at the same time; and one or two did not favour their going into any expenditure upon the works at present. I incline to the latter view. But the Commissioners have all the impetuosity of youth upon them; and they resolved, without a division, to go on with both improvements. The cost of the oil-gas installation will be about £300. The amount being so small, it was felt that it would add little to their liabilities; and the belief was expressed that it would be a source of profit to the Commissioners. It also appeared that the Manager (Mr. P. Watson) was very anxious to have the oil process; and its introduction is largely owing to his pressure in the matter. It is a very pleasing feature of the Commissioners that they should, at this early stage of their history, show such unbounded confidence in their Manager. As to expenditure, the Commissioners ought really now to call a halt. The £3000 or so which they are about to lay out should have the effect of lengthening the life of the works so far as to give them time to settle down to work, and acquaint themselves with the necessities of the undertaking—for instance, whether they should remove the works to a new site.

If I should feel somewhat ruffled at the treatment which oil-gas has received from the Edinburgh and Leith Gas Commissioners, the action of the Falkirk Commissioners goes a long way to supply soothing reflections. But I have a higher joy yet to record; for on Monday of this week the Gas Committee of the Greenock Corporation, with their friends assembled, at the call of Bailie M'Innes, the Convener, drank to the toast of "Success to the introduction of oil-gas." The Peebles process, which the Corporation have introduced—and the plant for which has been most efficiently fitted up by Messrs. Hanna, Donald, and Wilson, of Paisley—has, as was stated in last week's "Notes," given the utmost satisfaction. Though it has been in use for a considerable time, the Corporation have refrained from everything of the nature of crowing over it till they should see how it is working. Now that success has been assured, they got up a little function, to which they invited a number of leading citizens of their own and neighbouring towns. The company were shown the plant at work, and were then treated to cake and wine. The Convener, in proposing the leading toast, which I have given, dilated upon the advantage which oil gas is conferring upon the Corporation and the community. In all directions, he said, there had been considerable expressions of satisfaction in regard to the improvement in the illuminating power of the gas. He enforced the healthy notion that those who are interested in gas undertakings must be on the alert to inquire into, and if advisable, to introduce new methods which might lead to economy in working, and to the providing of gas of the best quality at the cheapest possible rate. The health of Mr. W. Young was toasted; and Messrs. Hanna, Donald, and Wilson were also duly honoured.

The Dunfermline Gas Company have now transferred the whole of their business to their new works, and are proceeding with the dismantling of the old ones. The gasholders have disappeared; and the other plant is being removed. On Tuesday, the buildings and ground were exposed for sale in two lots—one at the price of £1500, and the other at £130. Property is selling very badly just now; and no offer was given for either of the lots. The sale was accordingly adjourned; and the subjects are to be again put up for sale by auction on Tuesday, the 16th of April.

This week the Convention of Burghs held their annual sittings in Edinburgh. The zeal of newly-fledged officials was exemplified by a motion submitted by Mr. J. Wilson, the Town Clerk of Falkirk, which started with the proposition that the present method of rating gas and water works is most inequitable and objectionable, and then asked the Convention to petition the Government to bring in a Bill dealing with the subject on the lines of the recommendations of a Select Committee of the House of Commons, who reported some years ago. The motion was unanimously adopted.

Sulphate of ammonia is now £3 8s. 9d. per ton lower in price than it was a year ago.

The Electric Lighting Committee of the Edinburgh Town Council had before them on Tuesday the motion which had been remitted to them with reference to the prevention of explosions in electric light culverts. The Committee are not so magnanimous as the Gas Commissioners, who have not endeavoured to throw blame on the Committee. They agreed that the special attention of the Gas Commissioners should be called to the large amount of leakage of gas which takes place, and the desirability of examining and renewing old pipes, so as to give more security, now that the electric light is being introduced. The Committee were of opinion that the subsoil of Edinburgh is very much saturated with gas which has escaped. Everything, it is stated, which the Committee could do, has been done to make tight the mains and conduits for the electric light. Well, the "everything which could be done" does not appear to be "everything," if seeing is believing. I saw the cover of an electric light box lifted in Princes Street the other day; and either it or some part of the plant in the neighbourhood is not water-tight, for there was water in the bottom of the box. The Committee should board up their windows before they indulge in the dangerous game of throwing stones.

In a lecture which Mr. J. M. Gale, the Engineer to the Glasgow Water Trust, delivered to the Institution of Engineers and Shipbuilders in Glasgow, on Tuesday night, upon "The Extension of Loch Katrine Water-Works," he said that the parliamentary estimate of the new works was £1,205,000; and of this sum there had been expended £955,000. There was much work yet to do; but it was expected that the aqueduct would be finished under the estimate. Craigmaddie Reservoir, however, would cost about £100,000 more than the parliamentary estimate, in consequence of the difficulties in the construction of the puddle trench and the purchase of additional lands. The new reservoir would give a supply of 40 million gallons of water per day, which would make the total supply from Loch Katrine and Loch Arklet 80 million gallons per day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 30.

Sulphate of Ammonia.—The market has remained very quiet; the Continental orders being still on a very small scale, and the home demand so far has not shown much development. The Glasgow and Leith values are quoted as a lever to reduce prices at English ports to a lower level; but makers generally will not accept the low rates talked about—preferring to wait to see whether next month will bring some revival. Under existing circumstances, it is still very difficult to define the future of the market; but present moderate prices ought to give some stimulus to the demand. Sales have been at very variable prices; and quotations are more or less nominal. Nitrate on spot has declined to 8s. 6d. per cwt.

LONDON, *March* 30.

Tar Products.—For forward delivery, 90's benzol is reported to be of better value; but both it and 50's rather "hang fire" for early delivery. There is very little demand for 50's. Solvent naphtha also continues flat. Anthracene is much easier; and buyers seem to have booked their requirements for the present. It looks as if "B" anthracene will be cheaper; while "A" anthracene is reported to be scarce. Pitch is steady at 32s. to 34s., according to position and quality; while carbolic acids are not realizing expectations—it being usually in better request at this period of the year for summer consumption. Values are as follows: Tar, 18s. to 21s. 6d. Pitch, 32s. to 34s. Benzol, 90's, 1s. 1d.; 50's, 1s. 0½d. Solvent naphtha, nominal, 1s. 1d. Toluol, 1s. 2d. Crude (30 per cent.) naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, 1⅜d.; salts, 20s. Cresylic acid, nominal, 1s. Carbolic acid, 60's, 1s. 6½d. Anthracene, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia has not yet recovered from the drooping tendency which has characterized it now for some time. It is expected, however, with brighter weather, that better values will be obtained. Business during the week has been done at the following prices: Beckton, £10 10s.; Hull, £10 12s. 6d.; London, £10 15s.; Leith, £10 12s. 6d.; Western ports, £10 15s. Excepting Beckton, all less 2½ per cent., usual conditions as to bags and shipment f.o.b. Gas liquor is quoted at 7s. 6d. to 9s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business doing in the coal trade here is steadily diminishing in weight; the demand for most descriptions of fuel showing a decided quietening down. Although there is perhaps no actually quotable giving way on late rates, an easing tendency is noticeable as regards prices; concessions of 3d. to 6d. per ton being asked for buyers who have orders of any weight to place. Pits generally are getting on to less time; and four days a week is now about the average. For house-fire purposes, the better qualities of round coal are in but limited demand; and prices are not so firm as they were. Generally, best Wigan Arley is still quoted about 10s. 6d. to 11s. per ton at the pit mouth; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s. 6d.; and common qualities of house coal, 7s. 6d. to 8s. The lower descriptions of round coal meet with only a very indifferent sale for iron-making, steam, and general manufacturing purposes; and supplies of these are getting largely in excess of requirements, with the result that on orders for quantities of any substantial weight buyers can make purchases at very low prices. The average selling figures for ordinary steam and forge coals is about 6s. to 6s. 6d. per ton at the pit mouth. A fair demand comes forward for engine classes of fuel, and collieries in some instances are disposing of the present small output pretty readily; but supplies are still plentiful in the market, and prices rule extremely low—especially for the inferior sorts. At the pit mouth, the better qualities of slack average from 4s. 6d. to 5s. per ton; but the commoner descriptions of engine fuel are now obtainable at from 3s. to 4s. per ton. For shipment, business is extremely slow, with an easy tone in prices; some of the inferior descriptions of steam coal being obtainable at as low as 7s. 6d. per ton delivered at the Lancashire ports, with good ordinary qualities fetching not more than 8s. to 8s. 3d.

Northern Coal Trade.—The coal trade in the North has to some extent resumed its normal character; and as the time has arrived when many of the contracts for coal are allotted for the shipping season, there has been a good deal of interest felt in the decision thus arrived at as to prices. There have been gas-coal contracts for Rotterdam, for Malmo, and for Sulina; whilst the chief of the steam coal contracts has been that for the Russian naval supply. The course of prices has not only been downwards, but it has been such as to show a divergence of view that is remarkable between the members of the coal combination of Durham. The large contract for Cronstadt for steam coals was taken at about 12s. 2d. per ton delivered—or equal to about 8s. 3d. f.o.b.—a rate that is below that current in the market now, and that tends to show a belief in the minds of some that either prices of coal or freights of steamers will fall lower. Steam small coal is rather scarce, and consequently steadier in price at about 3s. 6d. per ton. In regard to the gas-coal contracts, two-thirds of that for Rotterdam has gone to Germany—the first time that so large a proportion has been allotted there; and the remainder is to be supplied from Durham collieries, at a price of about 10s. 9d. per ton delivered. The effect of the combination is evident in thus driving this contract in large part to Germany, after it had been long supplied from here. It is believed that it may induce the coalowners in some degree to moderate their views as to price. The large London gas-coal contract is in the market; but no decision is as yet known, though it seems probable that lower prices will be taken. Coke is rather quieter; the price varying from 12s. 6d. to 13s. 6d. per ton f.o.b. Exports are rather fuller than they were. There is no alteration in the position or price of gas coke this week.

Scotch Coal Trade.—There is little to record with reference to the coal trade in Scotland. A fair business is being done, but at rates which coalowners do not look upon as remunerative. Steam coal is in excess of the demand for it. Splint is also plentiful; but the price keeps fairly steady. Ell is the most satisfactory of all the varieties; there being a good foreign demand for it, and considerable orders booked ahead. Main is quiet; and the price is unaltered. There is a proposal for the establishment of a sliding-scale of wages in Fifeshire; but the men do not seem to favour it, as they expect prices to rise when the Baltic ports are opened. The prices quoted are: Main, 6s. to 6s. 3d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 9d. The shipments for the week amounted to 123,555 tons—an increase upon the quantity in the preceding week of 5184 tons, but a decrease as compared with the corresponding week of last year of 17,634 tons. For the year to date, the total shipments have been 1,207,622 tons—a decrease on the same period of last year of 336,286 tons, and as compared with the same period of 1893 of 25,428 tons.

Gas Exhibition at Derby.—Under the auspices of the Derby Gas Company, an exhibition was opened in the Drill Hall last Wednesday, by the Mayor (Mr. G. Bottomley, J.P.). The exhibition, the principal appliances shown at which were furnished by the Davis Gas-Stove Company, Limited, and Messrs. Richmond and Co., Limited, was admirably arranged. There was a large attendance; and, in inaugurating the exhibition, the Mayor made a practical speech.

The Barnsley Water Bill.—The Barnsley Corporation have petitioned the House of Lords to be permitted to insert further provision in their Water Bill, enabling them to extend the limits within which they are seeking power to supply water so as to include the townships of Notton and Woolley, in the district of the Barnsley Rural District Council, and the township of South Elmsall, in the Hemsworth Rural Council district. The matter came before the Standing Orders Committee last Thursday; and it was decided to allow the clause.

The Sale of Gas Residual Products in Glasgow.—From June 1, 1894, to Feb. 28, 1895—nine months of the financial year—the revenue derived by the Glasgow Gas Trust from the sale of residual products amounted to £106,920, as compared with £88,595, the income from the same source for the corresponding nine months of 1893-4; showing an increase amounting to £18,325. As people connected with the gas industry generally are possibly not aware of the arrangement for fixing the prices of the residuals from time to time, it may be stated that a well-known chemical broker in Glasgow—Sir J. N. Cuthbertson—was some years ago mutually chosen by sellers and buyers to discover the average prices paid throughout the kingdom, which both parties agreed to abide by. Sir John's services are acknowledged in a very substantial manner by buyers and sellers.

Dorking Gas Company.—The half-yearly meeting of this Company was held last Tuesday. The accounts for the six months ending Dec. 31 showed that, after providing for the interest payable on the debenture stock, there was a balance of £2197 available for division. The Directors recommended the payment of dividends at the rates of 10 per cent. on the "A" and "B" shares, and 7 per cent. on the "C" shares. The payment of these will absorb £813; and leave £1384 to be carried forward, as against £965 in the previous half year. The Directors reported that the manufacturing operations had been satisfactory during the six months, and that there had been a gratifying increase in the sale of gas. With the view of further stimulating the consumption, they had decided to make a reduction of 3d. per 1000 cubic feet on the present price from Jan. 1 last, by way of discount for prompt payment. This, they felt assured, would further increase the prosperity of the Company. The adoption of the report was moved by Mr. W. T. Butler, who presided in the absence of the Chairman (Mr. J. Young); and the motion was carried.

Sales of Stock and Shares.—At the offices of the Newcastle and Gateshead Water Company last Tuesday, Mr. C. A. Joel offered for sale by auction 5 per cent. preference stock of the Company to the nominal value of £80,000. There was a large attendance, and bidding was brisk. The first 40 lots were sold for £155 per cent.; but this was the lowest price realized during the sale. By far the greater part of the stock brought £158 10s.; and the maximum price given was £160. Forty lots of stock were sold for £155 per cent.; 20 lots, for £156; 10 lots, for £156 10s.; 15 lots, for £157; 20 lots, for £157 10s.; 25 lots, for £158; 374 lots, for £158 10s.; 70 lots, for £159; 160 lots, for £159 10s.; and 71 lots, for £160. The sale produced more than £127,000 for the £80,000 stock; being, on the average, a little above £159 per cent.——Messrs. Kidwell and Sons recently sold at Chatham 22 £5 shares in the *Brompton, Chatham, and Rochester Water Company* at £15 and £15 2s. 6d. each.——Some "A" and "C" shares in the *Eastbourne Gas Company* were sold by auction last Tuesday at from £29 2s. 6d. to £29 7s. 6d.; and "B" shares at from £23 2s. 6d. to £23 10s.—— Fully-paid £10 shares in the *Bingham Gas Company* changed hands last week at £12 5s. and £12 2s. 6d.——On Tuesday, 73 £7 shares in the *Stranraer Gas Company* were sold as follows: 20, at £12 5s. each; 20, at £12 2s. 6d.; and 33, at £12.

Torquay Gas Company.—The annual meeting of this Company was held on the 22nd ult. Mr. W. H. Kitson presided; and, in moving the adoption of the report, he stated that the working of the past year had produced a good balance-sheet. The total receipts amounted to £25,710, against £24,953 in the preceding year; and the expenditure, to £18,312, against £17,875—leaving a balance of £7390, as compared with £7079. The full dividend amounted to £6373, against £6302. The Company's new Act enabled them to raise £50,000 of ordinary capital, and £12,500 by mortgage; and this, it was hoped, would meet the requirements of the Company for some years to come. They were now erecting a very large gasholder, which it was expected would be finished early in June, and which would hold 485,000 cubic feet of gas. The Directors had been able to take up at 3 per cent. the remaining £7500 authorized under the old Act. Having mentioned that there were 423 cooking-stoves in use, the Chairman alluded to the consideration of the introduction of electric lighting by the Town Council, and said the cost, if the gas-lamps were supplanted by electricity, would be considerably greater than at present. In some quarters there seemed to be a desire that the Council should purchase the gas-works; but he did not think the consumers would find the change an advantage. The Directors had decided to make a reduction in the price of gas from 3s. 3d. to 3s. per 1000 cubic feet from July next. The report was adopted.

The Brentford Gas Company and Meter-Rents.—At the meeting of the Hammersmith Vestry last week, a letter was read from the Brentford Gas Company, stating that at the present time they did not see their way to abolishing meter-rents. The Company had about £50,000 of capital invested in meters; and, if no meter-rents were charged, this would be unproductive, and tend to prevent further reductions in the price of gas.

Gas-Main Extensions in Glasgow.—With the view of improving the gas supply in the northern and south-eastern suburbs of "Greater Glasgow," more especially from the Dalmarnock works, the Corporation Gas Committee of that city recently resolved to lay great stretches of large street mains, generally 24 and 18 inches in diameter. Of the former, 820 12-feet lengths were ordered; and of the latter, 1340 pipes of the same length. These, together with the "specials" required, give a total length of nearly six miles. The contract for the supply of the piping was placed with Messrs. R. Laidlaw and Sons.

The Management of the Huntingdon and Godmanchester Gas-Works.—At the recent meeting of the Huntingdon and Godmanchester Gas Company, attention was called to the serious losses of gas said to be due to leakage. The Chairman (Mr. F. J. Howson) explained that this was a matter which the Directors had had before them for years past; and believing it to be due to defects in the works, they had spent a large sum in renewing the mains, providing a new gasholder, and in other ways. But finding this year that these efforts made no sensible diminution in the unaccounted-for gas, they had called in Mr. W. R. Phillips, of Luton, who had advised them that the loss was probably due to a great extent to defects in making the gas rather than to leakage. The shareholders requested the Directors to carry out the recommendations made by Mr. Phillips, and to change the management of the works. Dividends of 8 and 10 per cent. were declared.

Anniversary of the Gas Workers' Union.—The sixth anniversary of the Gas Workers' Union was held last Sunday in Victoria Park. The various contingents started, accompanied by bands, in time to reach the meeting-place by 3.30 p.m. The following resolution was submitted from two platforms, at one of which Mr. R. Shewry presided, and at the other Mr. Pete Curran—"That this meeting calls upon all the London workmen to join their respective Trade Unions, with a view of getting a better standard of living, and pledge themselves to work for the bringing about of such economic reforms as will do away with the present competitive system." The General Secretary (Mr. W. Thorne) was one of the speakers. In the course of his remarks, he said that the employers and capitalists were to-day better organized than they had ever been before. It was the plain and clear duty of every Trade Union to loyally federate, and act in unison the one with the other. A scheme had already been drawn up, and would be presented for the consideration of the Trades Union Congress when it met at Cardiff. The proposal dealt with the federation of all Trade Unions, so that in the future more effective action could be taken by them than had been done in the past. Mr. Keir Hardie, M.P., also addressed the meeting. The resolution was unanimously adopted. We find, from the statement of receipts and expenditure of the Union for the past year, which has been issued by the General Secretary, that the income amounted to £8695, of which £8336 was contributed by members. With the balance in hand at the beginning of the year added (£6217), a total of £14,912 is shown. In the past twelvemonth, the expenditure was £8029, of which £3916 was strike and lock-out pay, contributions to other Unions, and payments to "victimized" members; salaries (15 officials) came to £1664; printing and stationery, to £588; travelling expenses, to £469; and delegations and meetings of Council and Executive Committee, to £377. The funds at the close of the year amounted to £6883, of which £4000 was invested at the Bank rate, £2147 on current account in banks, £154 in the Post Office, and £582 remained in the hands of officers.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 639.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Oct.	10½	Alliance & Dublin 10 p. c.	10	21½–22½	+½	4 13 4
100,000	10	,,	7½	Do. 7 p. c.	10	14½–15½	..	4 16 9
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 4
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¼–6¾	..	4 16 5
40,000	5	,,	6½	Do. New	4	4¾–5	..	5 4 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	243–248	..	4 12 8
180,000	,,	,,	8½	Do. New	100	195–200	..	4 5 0
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220–225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	118–121	+3½	4 2 8
320,000	20	28 Mar.	11½	British	20	50–51*	..	4 8 2
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	21–22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16–17	..	5 0 0
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6¼–6¾	..	2 19 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100–103	..	5 16 7
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26½–27½	..	6 0 0
550,000	Stck.	11 Oct.	13¾†	Commercial, Old Stock	100	287–292	..	4 12 5
165,000	,,	,,	10¾†	Do. New do.	100	215–220	..	4 15 5
160,762	,,	13 Dec.	4½	Do. 4½ p. c. Deb. do.	100	130–135	..	3 6 8
800,000	Stck.	13 Dec.	13	Continental Union, Limited.	100	247–252	..	5 3 2
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	205–210	..	4 15 3
535,600	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	118–123	..	4 5 4
486,090	10	31 Jan.	11	European, Limited	10	24–25	..	4 8 0
354,060	10	,,	11	Do. Partly paid	7½	17–18	+½	4 11 9
5,616,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	267–272	+2	4 8 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105–110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275–280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197–202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	183–188	..	3 14 6
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275–280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	163–168	..	3 11 5
1,061,150	,,	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	128–131	+1	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140–145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	188–192	..	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	240–245	+2	4 18 0
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5¾–6¼	..	4 16 0
560,000	100	1 Oct.	5	Met.of Melbourne, 5 p.c. Deb.	100	111–113	..	4 8 6
541,920	20	14 Nov.	5	Monte Video, Limited	20	15½–16½	..	6 1 2
150,000	5	29 Nov.	8	Oriental, Limited	5	7–7¼	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾–5*	+¼	7 0 0
166,870	10	14 Feb.	2	Para, Limited	10	1¾–2¼	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105–109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	102–107	..	5 12 1
150,000	10	11 Oct.	6	San Paulo, Limited	10	8¾–9¼	..	6 6 4
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	350–360	–5	4 6 1
1,350,000	,,	,,	12	Do. B do.	100	290–300	–½	4 0 0
290,000	,,	,,	13	Do. C do.	100	300–305	–7	4 5 3
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	167–172	..	2 18 2
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	28 Dec.	10⅝	Chelsea, Ordinary	100	278–283	..	3 11 6
1,719,514	Stck.	11 Oct.	8	East London, Ordinary	100	220–225	–1	3 11 1
654,740	,,	28 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147–152	..	2 19 2
700,000	50	13 Dec.	8½	Grand Junction	50	110–114	..	3 14 6
708,000	Stck.	14 Feb.	12	Kent	100	300–305	–2½	3 18 8
1,043,800	100	28 Dec.	9½	Lambeth, 10 p. c. max.	100	246–251	–1	3 15 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200–205	..	3 13 2
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132–136*	+½	2 18 10
500,000	100	14 Feb.	12½	New River, New Shares	100	370–380	..	3 7 0
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	140–143	..	2 15 11
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	147–152	–1	3 19 0
126,500	100	,,	6	Do. D 7½ p.c. do.	100	140–145	–12	4 2 9
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	267–272	–1	3 13 7

*Ex div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

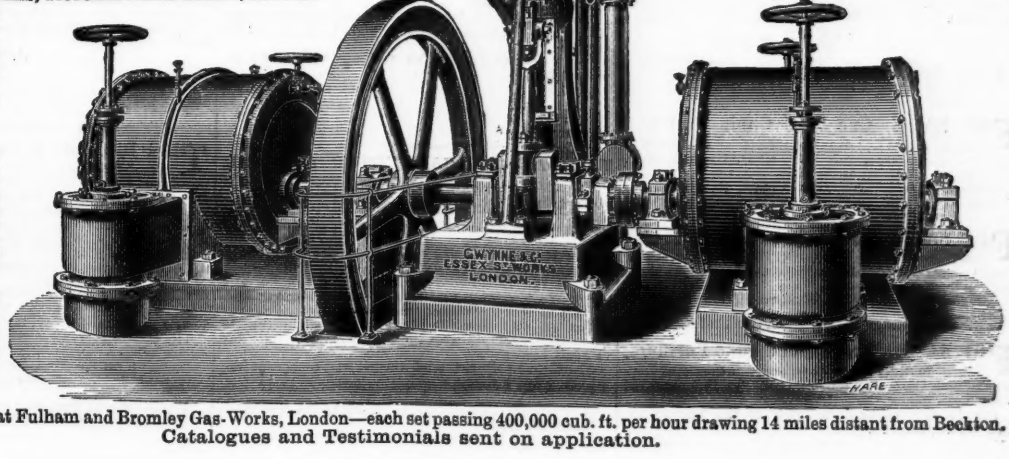
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.
Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND Co., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

WANTED, a Situation as Junior Clerk in a Gas Company's or Builder's Office. Has slight knowledge of Drawing and Building Construction. Address R. O. P., Central Gas Offices, CHELTENHAM.

WANTED, a young Gentleman to assist in the Laboratory and Drawing Office. Applications, with *copies* of recent Testimonials, to R. O. PATERSON, Gas-Works, CHELTENHAM.

PUPIL.

THE Engineer of a Gas Company supplying a high-class watering place has a vacancy in his Office for a well-educated, gentlemanly Youth as a PREMIUMED PUPIL. Exceptional opportunities of gaining a thorough knowledge of the principles of Modern Gas Engineering.
Address No. 2504, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an energetic Traveller (home and abroad) for Coal, Cannel, and Iron. Salary to commence at from £300 to £500 per annum, according to Experience and Connections. Travelling and Hotel Expenses paid.
Please state Age, what knowledge of Foreign Languages, and Particulars as to whole past career, and present position, to TRAVELLER, care of Messrs. Street and Co., 30, CORNHILL, E.C.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

WANTED, an experienced Plumber as a WASTE-WATER INSPECTOR. One who has been accustomed to Deacon's Waste-Water System, and who holds a Certificate from the Worshipful Company of Plumbers, preferred.
Wages £2 per week.
Candidates to make application, in their own handwriting, to the Secretary at the Company's Offices, Commercial Road, Portsmouth, on or before Monday, the 15th of April next, stating their Age, Qualifications, and where last employed, and enclosing Testimonials.

By order,
R. W. FORD,
Secretary.

Offices: Commercial Road, Portsmouth,
March 26, 1895.

FOR SALE—One 5000 Cubic Feet per hour ROTARY EXHAUSTER and ENGINE combined; also 5000 Cubic Feet EXHAUSTER, without Engine. Both perfectly new.
Apply QUEEN STREET IRON-WORKS, Ravensthorpe, YORKS.

FOR SALE, cheap—One 20,000 cub. feet per hour Beale's EXHAUSTER, with two 8-inch Disc Valves. Also one to pass 5000 Cubic Feet per hour. Both in perfect condition.
Apply to SAMUEL WHILE, 60, Queen Victoria Street, LONDON, E.C.

FOR SALE—Two second-hand Purifiers, Size, 10 ft. by 5 ft. by 8 ft. deep, inside measurements, with Covers and Wood Grids, by Dempster, of Elland, complete.
For further Particulars, apply to the SECRETARY, Gas-Works, BRECON.

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also Improved Patent Rotary Scrubber-Washers.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

HYDRAULIC MAINS.

ACCUMULATION of thick Tar entirely prevented. A great reduction in Stopped Ascension-Pipes by using CARPENTER'S PATENT HYDRAULIC MAIN CLEANER. No expense beyond first cost.
All Particulars on application to S. & H.W. CARPENTER, Vulcan Iron-Works, Rhodeswell Road, Limehouse, LONDON, E.

TORQUAY GAS COMPANY.

TO BE SOLD, at once—A Small Gas- HOLDER, 70 feet diameter and 20 feet deep. New Top Plates nine years ago. Been in use 35 years. Also 78 feet run of WROUGHT-IRON HYDRAULIC MAIN, ⊓ Section, suitable for Benches of Sevens, and several tons of 4-inch DIP-PIPES, ⊦-PIECES, &c.
Terms and Conditions, and further Particulars, on application to ROBERT BEYNON, Gas-Works, Hollacombe, PAIGNTON.

COAL AND CANNEL.

THE Aberavon Corporation invite TENDERS for 500 to 1750 tons of large GAS COAL and 250 tons of CANNEL, delivered f.o.b. or f.o.r. at Port Talbot.
Tenders, stating description, &c., and endorsed "Gas Coal," to be sent to the undersigned, on or before April 13, 1895.
The lowest or any tender will not necessarily be accepted.

By order,
M. TENNANT,
Town Clerk.

Aberavon.

THE LLANDUDNO URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Llandudno Urban District Council invite TENDERS for the supply of 4500 tons of COAL, capable of producing a minimum of 9500 cubic feet of 17-candle Gas per ton, to be delivered, carriage paid, between the 1st of July, 1895, and the 30th of June, 1896, at the Llandudno Station of the London and North-Western Railway, in such quantities and at such periods as may be ordered from time to time.
Tenders, endorsed "Tender for Coal," to be sent to the undersigned not later than Tuesday, the 16th day of April, 1895.
The Council do not bind themselves to accept the lowest or any tender.

A. CONOLLY,
Clerk to the Council.

March 27, 1895.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

In Paper Covers, Post Free, Price 2s.

S. CARPENTER on the Purification of COAL GAS from CARBONIC ACID and the SULPHUR COMPOUNDS by LIME, OXIDE OF IRON, and ATMOSPHERIC AIR.
S. & H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

CORPORATION OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive, on or before Tuesday, the 30th of April next, OFFERS of High-Class CANNELS and COALS suitable for Gas Making, for delivery at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three Years commencing the 1st of June, 1895.
Particulars and printed Forms of Tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
March 29, 1895.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of 10,000 tons of COAL.
Specification and Form of Tender may be obtained on application to Mr. Whatmough, Gas Manager.
Contractors tendering must pay their workpeople at least the standard or trade union rate of wages, and observe the trade conditions which attach to the various kinds of work for which the tender is sent in.
Sealed tenders, endorsed "Coal," to be sent to me not later than Tuesday, April 16, 1895.

By order,
A. B. PILLING,
Town Clerk.

Municipal Buildings, Heywood,
March 30, 1895.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO GAS ENGINEERS AND OTHERS.

THE Gas Committee are prepared to receive TENDERS for an enlargement of ANNULAR CONDENSERS at their Portwood Works.
Specification may be seen and all Information obtained on application to the Engineer (Mr. S. Meunier), Millgate Works, Stockport.
Tenders, endorsed "Condensers," and addressed to the Chairman of the Gas Committee, must be sent in not later than Three p.m. on the 11th of April, 1895.
No tender will be accepted without satisfactory proof that the firm tendering pays the standard rate of wages, and observes the standard number of hours.
The Committee do not bind themselves to accept the lowest or any tender.

By order,
WALTER HYDE,
Town Clerk.

Stockport, March 29, 1895.

KETTERING WATER-WORKS COMPANY.

THE Directors of the Kettering Water- Works Company invite TENDERS for the construction of a SERVICE RESERVOIR at their Clover Hill Pumping-Station, Kettering.
Drawings and Specification may be inspected, and Quantities, and Forms of Tender obtained, at the Company's Offices, 4, Newland Street, Kettering, and at the Office of the Engineer, Mr. Thomas Hennell, C.E., 6, Delahay Street, Westminster, London, on and after Monday, the 8th of April.
Tenders, sealed and endorsed "Tender for Reservoir," are to be delivered at the Office of the Company, on or before Noon on Monday, the 22nd of April, 1895.
The Directors will not necessarily accept the lowest or any tender.

By order,
THOS. ALLAMBY SIMPSON,
Secretary and Manager.

Water Office, 4, Newland Street,
Kettering, April 2, 1895.

The List for Applications will close on or before Wednesday, April 3, 1895, for London, and Twelve o'clock the following day for the Country and Abroad.

THE
Prepayment Gas-Meter Company, Limited.

CAPITAL - - - £75,000, divided into 75,000 Ordinary Shares of £1 each.

ISSUE OF 65,000 SHARES, PAYABLE AS FOLLOWS:—

On Application, 2s. 6d.; on Allotment, 7s. 6d.; and the balance in Two Calls of 5s. each, at not less intervals than Two Calendar Months from the last preceding call.

DIRECTORS.

Major W. F. GORDON (Director of the Bombay Gas Company, Limited), St. Edmund's Wimbledon, Chairman.
GEORGE B. CLIFF, Esq. (Chairman of the Northwich Gas Company), Moss Cliff, Northwich.
ROBERT CURPHEY, Esq. (Director of the Manx Bank, Limited), Verona, Douglas, Isle of Man.
J. R. LINDSAY DAISH, Esq., The Grange, Edinburgh.
* R. W. BROWNHILL, Esq. (late Mayor, and Chairman of Gas Committee for Walsall), Aston, Birmingham.

* Will join the Board after completion of the purchase.

Bankers.—The Manchester & Liverpool District Banking Corporation, Limited, 75, Cornhill, London, E.C., Manchester, Liverpool, & Branches.

Solicitors.—Messrs. Francis and Johnson, 26, Austin Friars, London, E.C.

Auditors.—Messrs. Sellars, Dicksee, & Co., Copthall House, London, E.C. **Secretary.**—T. Gardiner Harvey, Esq.

Offices.—Blomfield House, 52, New Broad Street, London, E.C.

PROSPECTUS.

This Company is formed to acquire and work the Letters Patent 12,184. of 1893, granted to, and hitherto owned by, Mr. R. W. Brownhill, of Birmingham, for automatic prepayment, sale and delivery attachments for gas and liquid meters (commonly called "Penny-in-the-Slot Gas-Meters") for the United Kingdom of Great Britain, and (when applied for and obtained) the United States of America and the Dominion of Canada, together with all previous Letters Patent granted to him or relating to such meters, and the benefit of the royalties reserved by two licenses given in respect of one of these previous patents.

The popularity of these meters and their necessity are proved by the fact that thousands are already in use, and that the demand greatly exceeds the supply. This Company is formed for the purpose of manufacturing meters, together with Mr. Brownhill's patent prepayment attachment, and meeting the constantly increasing demand.

There being considerable profit attached to the manufacture and sale of meters and attachments, it may be confidently anticipated that, when the Company is in working order, a highly remunerative business will result; and a further source of profit may be expected from the sale and granting of licenses under foreign and colonial patents.

The Prepayment Gas-Meter is a ready means for gas consumers generally, but specially for small consumers, to pay for their gas in advance, and in small quantities, either daily, weekly, monthly, or at any given period in which a certain quantity is required.

The benefit to the small consumer is evident, as he has no calls nor collectors dunning him for the payment of his gas bill. When he has used his pennyworth, he can always drop in another penny and start afresh. He need not fear having his gas cut off; he pays as much as he can or likes; consumes what he pleases; and becomes his own master, so far as his gas supply is concerned.

To the gas companies of the United Kingdom the Prepayment Gas-Meter offers enormous facilities for the extension of their supply, especially to small consumers. It is calculated that there are about 50 per cent. of non-consumers situated along the lines of gas-mains in districts where there is a good supply at the door. No expensive system of collection need be adopted; and the cash is always paid in advance before the gas is consumed.

Mr. George Livesey, in his speech to the shareholders of the South Metropolitan Gas Company, on Aug. 15, 1894 (as reported in the JOURNAL OF GAS LIGHTING of Aug. 21, 1894), stated as follows: "In the third paragraph of the report, the Directors referred to the Penny-in-the-Slot Meters, the rapid demand for which had astonished them all. At the present time they had about 20,000 of these consumers; and they were putting in more than 300 meters a week. This entailed a good deal of trouble on their staff; and some people would ask what advantage the Company got out of these small consumers. In the first place, the Company said that, if they could meet the demands of the working classes for gas on such terms as would pay them without making any surplus profit at all, it was their duty to do so. This was the feeling of the Directors. They had been granted the monopoly of the supply of gas in a large district in South London; and if people wanted gas they ought to have it, if the Company could supply it without loss to themselves. It had not, however, been a loss. The 20,000 consumers he had mentioned burnt, on an average, about 12,000 cubic feet of gas a year, or 240,000,000 cubic feet. On 1,000,000 cubic feet of gas, they had about £50 profit; so that on 240,000,000 they would get a profit of £12,000 out of the Penny-in-the-Slot Meters." This experience of the South Metropolitan Gas Company proves that the adoption of the Prepayment Gas-Meter is not only a great convenience to the public, but also a source of considerable revenue to the shareholders of gas companies. It is believed that quite 3,000,000 of Prepayment Meters will be required by the several gas companies in Great Britain alone.

By their use, gas will be within the reach of the mass of the population as easily as petroleum, candles, &c., and may be purchased at even a pennyworth at a time, without any initial outlay or trouble, such as deposit, reference, or guarantee, as now required by the gas companies. The Prepayment Gas-Meter will, it is believed, to a very large extent supersede dangerous oil-lamps, and thus prevent the loss of many lives annually.

The demand for Prepayment Gas-Meters, which is already very considerable, especially for houses with rents ranging from £10 to £50 per annum, must necessarily increase according as their advantages become more widely and better known, as it will be a great convenience to the occupiers of such premises to pay for their gas only as required, and without trouble.

It would be impossible to enumerate the various uses to which the Prepayment Gas-Meter can be applied satisfactorily; but there can be no doubt that it will be in demand for:—

(1) Sub-tenancies in large manufacturing premises where each sub-tenant has to pay for gas. This is a large class, both in London and the Provinces.
(2) Stable and yard purposes, connected with hotels and other places of business.
(3) Householders generally.
(4) Flats and tenements.
(5) Furnished apartments and lodging-houses.
(6) Hotel bed and sitting rooms for gas-fires and heating purposes.

The meter attachments constructed under the Brownhill Patents have been examined by many of the leading engineers and others interested in Gas Supply, and have been favourably reviewed in the JOURNAL OF GAS LIGHTING, GAS WORLD, and other papers.

The principal patent to be acquired by the Company has been submitted to Mr. J. Fletcher Moulton, Q.C., M.P., and Mr. J. C. Graham, who have advised that it is good and valid, and effectual to secure to the Patentee the inventions therein claimed. It is for an attachment which can be applied to all meters, new or old, and which will deliver gas automatically in quantities as paid for by pennies deposited in a box. This attachment is constructed so that either only one penny at a time can be put into the box, or ten pennies can be put in consecutively, each penny paying for sufficient gas for one burner to last from five to six hours. When a gas consumer pays a penny or any number of pennies into the meter, the action of the meter will be at once operated upon to a proportionate extent. A dial will also at all times indicate the amount paid for, and not used. The light will diminish a quarter of an hour before the gas paid for is actually used up; thus giving notice that a further payment is required.

Estimates have been received for the manufacture of both gas-meters and the patent attachment at prices which will prove remunerative to the Company.

The following Agreements have been entered into—viz., an Agreement, dated Feb. 4, 1895, made between Rowland William Brownhill of the one part and Nicholas John Henry Schotborgh of the other part, and an Agreement, dated Feb. 4, 1895, made between the said Rowland William Brownhill of the one part and Thomas Gardiner Harvey, as Trustee for the Company, of the other part, by which last-mentioned agreement Mr. Brownhill agrees to transfer all his patents and royalties, and all present and future improvements, to the Company at the price (fixed by him) of £50.000, payable as to £5000 in cash, and the balance in cash or shares, or partly in cash or partly in shares at the option of the Directors. The remaining 25,000 Shares are reserved for working capital. The Vendor has agreed to pay all the expenses of the formation of the Company, and all preliminary expenses up to the first allotment of shares.

The above agreements, the joint opinion of Mr. Moulton, Q.C., and Mr. Graham, and copy of the Memorandum and Articles of Association of the Company, can be seen at the Office of the Solicitors to the Company.

Agreements have been entered into between the Vendor and other persons, relating to the procuring of capital, which may technically be Agreements within the meaning of the 38th section of the Companies Act, 1867, or Contracts to the disclosure whereof applicants for shares may be held to be entitled. Every applicant for Shares shall be deemed to have had full notice of such Agreements, and to have waived all further compliance with that section, and to have agreed with the Company, as Trustee for the Directors and other persons, if any, who might be liable, not to make any claim whatever, or take any proceedings under that section, in respect of any non-compliance therewith.

Applications for Shares must be made on the accompanying Form and forwarded to the Bankers or Secretary of the Company, together with a deposit of 2s. 6d. per Share applied for. If no Allotment be made the deposit will be returned in full; and if a less number of Shares be allotted than is applied for, the balance will be credited in reduction of the amount payable on Allotment.

Prospectus and Forms of Application can be obtained from the Bankers, Solicitors, or Secretary to the Company.

London, March 30, 1895.

This Form should be filled up and forwarded entire, with the amount of the deposit, to the Bankers of the Company. To be retained by the Bankers.

THE PREPAYMENT GAS-METER COMPANY, LTD.

FORM OF APPLICATION FOR SHARES.

To the Directors of the PREPAYMENT GAS-METER COMPANY, LIMITED.

GENTLEMEN,—Having paid to the Manchester and Liverpool District Banking Corporation, Limited, the sum of.....being a deposit of 2s. 6d. per Share on.....Shares of £1 each of the Prepayment Gas-Meter Company, Limited, I hereby apply for that number of Shares on the terms of the Prospectus dated March 30, 1895, and agree to accept the same, or any smaller number that may be allotted to me, and to pay the amount due thereon in accordance with the terms of the Prospectus; and I authorize you to place my name upon the Register of Members in respect of the Shares so allotted. I agree with the Company, as Trustees for the Directors and other persons liable, to waive any fuller compliance with Section 38 of the Companies Act, 1867, than is contained in such Prospectus. In the event of my not receiving an allotment, the amount to be returned in full.

Signature_____
Name (in full)_____
Residence_____
Profession or Occupation_____
_____ 1895.

If desirous of paying in full on A lotment, sign also here_____

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the purchase of a number of old WET and DRY GAS-METERS, a quantity of old BRASS, and also three old HORIZONTAL BOILERS, now lying at the Stores Department, 21, Dewsbury Road, Leeds, where the same can be inspected.

Tenders will be received, addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, not later than Wednesday, the 17th of April next, and endorsed "Tender for Old Meters, &c."

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply and erection, at their New Wortley Works, of six PURIFIERS, 30 ft. by 20 ft. by 6 ft., and the necessary VALVE CONNECTIONS, &c.

Plans may be seen and Specifications obtained on application to Mr. R. Smith, C.E., Engineer and Manager, New Wortley Gas-Works.

Endorsed tenders, addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, will be received not later than Saturday, the 13th of April next, endorsed "Tender for Purifiers."

LEEDS CORPORATION GAS DEPARTMENT.

TENDERS required as below:—

For Turned and Bored and other PIPES, BENDS, TEES, SYPHON WELLS, and other IRREGULAR PIPES.
For BRASS MAIN COCKS.
For 2½, 3, and 4 inch Self-faced BRADFORD or HALIFAX FLAGS.
For RETORT MOUTHPIECES, STAND-PIPES, DOOR-FRAMES, SPECIAL BENDS, TEES, FLANGE PIPES, &c.

Samples may be seen on application at the Stores Department, 21, Dewsbury Road; and Forms of Tender and Specification may be had on application at the Offices of the Gas Department, Municipal Buildings.

Endorsed tenders, addressed to the Chairman, at the Offices as above, will be received not later than Wednesday, the 17th of April next; and no tender will be considered except on the form provided.

The lowest or any tender will not necessarily be accepted.

March 30, 1895.

TENDERS FOR COAL.

THE Directors of the Enniskillen Gas Company invite TENDERS for the supply of large double-screened GAS COAL, for One or Three Years, at the rate of 1350 tons a year, in lots of 450 tons, to be delivered the second week in March, second week in July, and last week in October each year (the first lot to be delivered October, 1895), free from all liability, to the Gas Company at Enniskillen Stations. Must leave a good Coke, and work out, in practical working, near 10,000 cubic feet per ton of 16-candle Gas.

Payments one month after delivery, as per weight over the Gas Company's Weigh-bridge.

Tenders to be sent in to me by the 30th day of April, 1895.

For further Particulars, apply to

JAMES MALAM,
Chairman.

21, Sefton Street, Southport.

COUNTY BOROUGH OF WIGAN.

THE Gas and Electric Lighting Committee invite TENDERS as follows:—

CONTRACT No. 1.—Cast Mains and Connections.
" 2.—Wrought-Iron Tube and Fittings.
" 3.—Brass Tube and Fittings.
" 4.—Lead Pipe.
" 5.—Firing and Charging Shovels.
" 6.—Brooms.
" 7.—Wood Troughing and Covering.
" 8.—Galvanized Stove Pipe and Connections.
" 9.—Bar Iron.

The contracts will be for One Year, commencing on the 1st of April next ensuing, and ending on the 31st of March, 1896.

Forms of Tender to be obtained from the undersigned.

The Committee do not bind themselves to accept the lowest or any tender.

Tenders, sealed and endorsed with the name of the Articles tendered for (a sample of which must accompany each tender), to be delivered to J. J. Charnock, Esq., Town Clerk, Town Hall, Wigan, on or before Monday, the 15th of April next.

JOS. TIMMINS,
Engineer.

Gas-Works, Wigan,
March 28, 1895.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

J. A. KELMAN.

Winchester House, London, E.C.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

CLAPHAM BROS., LIMITED, of Keighley, Yorks., beg to intimate that they are the SOLE MAKERS of LAYCOCK & CLAPHAM'S "ECLIPSE" WASHER-SCRUBBER, and that no person or persons beyond the Patentees and Makers have ever had any interest whatever in the Patent.

They are also the SOLE MAKERS of CLAPHAM'S ATENT IMPROVED "ECLIPSE" CONDENSER, as supplied to Bradford, Manchester, and other Gas-Works.

Orders and Inquiries promptly attended to. See Advertisement in this week's JOURNAL, p. 728.

NOTICES FOR POSTING IN GAS-WORKS.

CARDS suitable for Exhibiting in Gas-Works, directing Officers and Workmen to REPORT all ACCIDENTS witnessed by them, together with the Clause of the "NOTICE OF ACCIDENTS ACT, 1894," specifying the notice required to be sent to the Board of Trade, can be obtained, *price 4d. each, or 2s. 6d. per dozen, post free.*

Section 4 of the "CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875," has been similarly printed. It is required, under a Penalty of FIVE POUNDS, that a Copy of the Section shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by persons employed thereat. Copies, in large type, on broad sheets (22½ inches by 17½ inches) may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C. *Price 2s. per dozen; 10s. 6d. per 100.* On Cards the same size as those relating to the "Notice of Accidents Act," *price 4d. each or 2s. 6d. per dozen.*

LOW MOOR BLACK BED
GAS COAL.

YIELD OF GAS PER TON · 10,375 CUBIC FEET.
ILLUMINATING POWER · 17·50 SPERM CANDLES.
COKE · · · · · · · 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ALEXANDER CAMERON,
CANNEL & GAS COAL MERCHANT,
48, WEST REGENT STREET,
GLASGOW.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

The LAW GUARANTEE & TRUST SOCIETY, LIMITED,
GUARANTEES FIDELITY.

Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.

HEAD OFFICE
49, CHANCERY LANE, LONDON, W.C.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

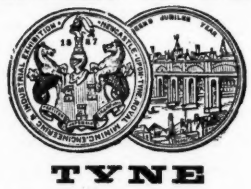
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.



TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS.

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

KENT'S THICK GAS COAL
RAISED AT
The Wharncliffe Woodmoor Colliery,
BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1).	1·276
Weight of One Cubic Foot.	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter.	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham,
8th August, 1894.

For Price, &c., apply to the
Wharncliffe Woodmore Colliery Co
BARNSLEY; LIMITED
Or to Mr. W. H. HARVEY,
17, Old Queen Street, Westminster, S.W.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.
IRONFOUNDERS,
MIDDLESBROUGH.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO.,
Central Plumbing Works, Town Hall Square, BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.
Special attention to Repairs.
Improved Lead-Burning Machines, Sulphate Bagging Machines, Copper Scoops, &c.

HIGHEST REFERENCES ON APPLICATION.

THE DRUM
FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.
See Advertisement in last and next issue.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

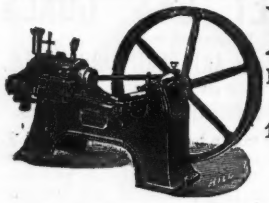
For Prices and Particulars, apply to
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

TAR AND LIQUOR PURCHASED.
JOHN CLARKSON MAJOR,
(Established 1851,)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.

T. B. KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T. B. KITTEL, SHEFFIELD.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.



DON'T BE PREJUDICED
Because the prices of Monarch Gas-Engines are so low, but if you are wanting, have one on trial, and prove conclusively that they are the best value on the market.
1½-B.H. Power, with Governors, &c., only £28 10s., less liberal terms. Other sizes to 12-H.P. in proportion. Catalogue of Telephones, Bell Speaking-Tubes, Electric Bells, &c., 4d.
W. H. BAUGHAN & CO., CHARLBURY.

THE NATIONAL.
Absolutely the Best Slot-Meter Obtainable.
GUARANTEED FOR 5 YEARS.

Telegraphic Address: "Stidder," London. Telephone Number, 4843.

Takes **PENNIES** and **HALFPENNIES** in the same slot, and supplies proportionate quantities of gas.

The coin-receiving mechanism is immensely strong, and so separated from the registering mechanism, that it is impossible to damage either, even with the most careless usage.

THE NATIONAL.

Will take a number of pennies, but cannot be jambed by the insertion of a second coin until the first is discharged.

Is compact and handsome; cannot be tampered with by any amount of ingenuity; whilst its mechanism is the simplest and strongest in the market.

Price changeable *in situ*.

WE INVITE YOU TO TEST THIS METER IN COMPETITION WITH OTHERS.

THE NATIONAL METER COMPANY, LIMITED.
OFFICE AND WORKS:
AQUINAS ST., STAMFORD ST., LONDON, S.E.

WILLEY & CO.

GAS ENGINEERS & CONTRACTORS,

Central Works: Commercial Road, EXETER;

Meter Works: James Street, EXETER.

Telegraphic Address: "WILLEY, EXETER." Telephone No. 132.

Edison-Bell Phonograph Used.

Metropolitan Agent: CAPTAIN ACLAND, M.Inst.M.E., Assoc.M.Inst.C.E., DOCK HOUSE, BILLITER STREET, LONDON.

Manufacturers of every Requisite for Gas-Works.

Specialities: GASHOLDERS, GAS-METERS, GAS-FITTINGS.

WILLEY AND CO. beg to announce that they have recently acquired the Sole Right and Proprietorship of the

"SIMPSON"

Automatic Penny-in-the-Slot Meter

(By Royal Letters Patent),

An application of the "Vernier Principle," ensuring Mathematical Accuracy of Registration, combining all the latest Scientific Improvements

PRICE INSTANTLY, SIMPLY, & READILY ADJUSTED *IN SITU*, BY SINGLE FEET OR HALF FEET, WITHOUT CHANGE OF WHEELS.

STRENGTH, DURABILITY, & MINIMUM SIZE.

AMPLE WARNING & GRADUAL EXTINCTION.

BASE OR MISTAKEN COIN DETECTED & RETURNED.

Terms on Application.

NEW CATALOGUE OF GAS-FITTINGS of novel and registered designs, with Special Quotations to Gas Companies, now in the Press for early circulation.

Agents for the "MAXIM PATENT CARBURETTOR" New Process of Gas Enrichment by Carburine.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

ORIGINAL MANUFACTURERS OF DRY METERS IN CAST-IRON CASES.

STATION METERS, EXPERIMENTAL METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

Results of Tests of Dry Gas-Meters (Section III.) of the Glasgow Philosophical Society's Gas Exhibition, as per London "Gas Journal," May 10, 1881.

	ALDER & MACKAY.	W. & B. Cowan.	G. Glover & Co.	James Keith.	D. B. Peebles & Co.
Total of Fast Tests . .	47·2 ..	6·9 ..	33·6 ..	62·3 ..	53·7
Total of Slow Tests . .	25·3 ..	117·4 ..	43·1 ..	31·4 ..	38·5
	72·5 ..	124·3 ..	76·7 ..	93·7 ..	92·2

Descriptive Circulars, Price Lists, and Full Particulars forwarded on application.

NEW GRANGE WORKS, EDINBURGH.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

Telegraphic Address: "ROBUSTNESS, London."

ROBUS'

Exchange Telephone No. 1758.

GASEOUS FIRING for Large or Small Settings.

INCLINED RETORT-SETTINGS, with or without Gaseous Firing.

RETORT-SETTINGS of exceptional Merit for Works on Wet Soils.

GASHOLDER TANKS

AND GAS AND WATER WORK, INCLUDING MAIN LAYING.

CONTRACTS Entered into for Retort Work of every kind, and all descriptions of Gas Apparatus. Guarantees given for the efficiency of our Work.

Plans, Specifications, and Estimates, with every Particular.

J. & H. ROBUS, Gas and Water Contracting Engineers, 20, BUCKLERSBURY, LONDON, E.C.

Telegraphic: "Fortress, Donnington, Salop."

C. & W. WALKER,

Telegraphic: "Fortress, London."

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

London Office: **10, FINSBURY SQUARE.**

PURIFIERS with Planed Joints.

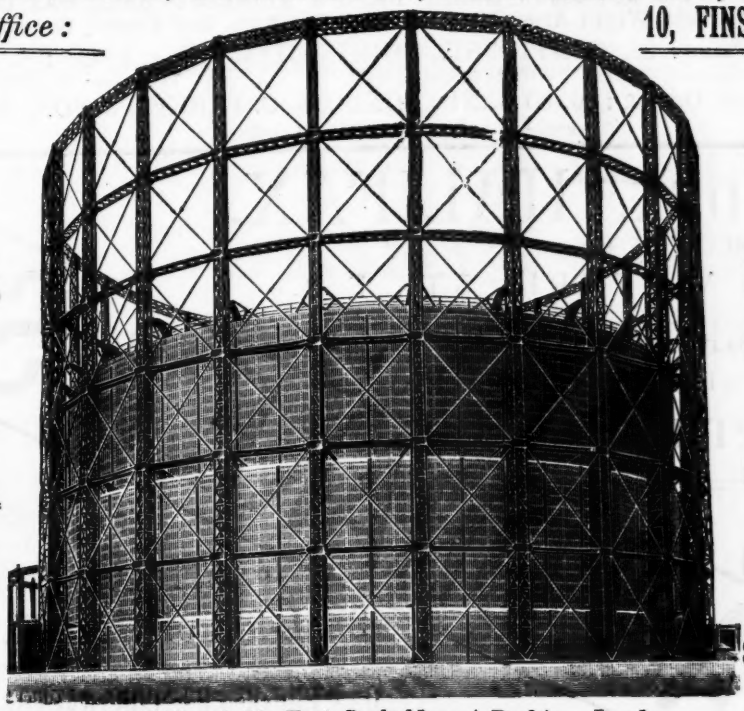
TOWER SCRUBBERS.

WECK'S PATENT CENTRE-VALVE.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



Eight Million Cubic Feet Gasholder at Beckton, London.

WASHERS.

WASHER-SCRUBBERS.

CLAUS' SULPHUR-RECOVERY PLANT.

CENTRE & FOUR-WAY VALVES.

CRIPPS' HYDRAULIC MAIN VALVE.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES.

WALKER'S PATENT PURIFYING-MACHINE.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms--

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

JONAS DRAKE & SON

OVENDEN, HALIFAX.

LONDON OFFICE

60, QUEEN VICTORIA ST., E.C.

SOLE MAKERS OF

"MITTON'S" PATENT SELF-SEALING

— RETORT-LID. —

Telegraphic Addresses:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

Telephone: No. 43.
HALIFAX EXCHANGE.

SOLE MAKERS OF

"SETTLE'S" PATENT COMBINED

SEAL-REGULATING FLUSH-VALVE

GAS ENGINEERS, CONTRACTORS, RETORT SETTERS, IRONFOUNDERS, FURNACE BUILDERS, &c.

GASEOUS FIRING A SPECIALTY.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD

SERVICE CLEANER.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,

MANUFACTURERS OF IMPROVED

WET AND DRY GAS-METERS.

STATION-METERS. LAMP-METERS.

TEST GASHOLDERS & GENERAL GAS APPARATUS.

BRASS MAIN & LAMP TAPS. UNIONS, FERRULES, &c.

The "Falcon" Lamplighter's Torch. Service Cleaners.

SYPHON AND OTHER PUMPS.

Wood and Wrought-Iron Purifier-Grids. Scrubber Boards.

WET AND DRY METERS REPAIRED.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

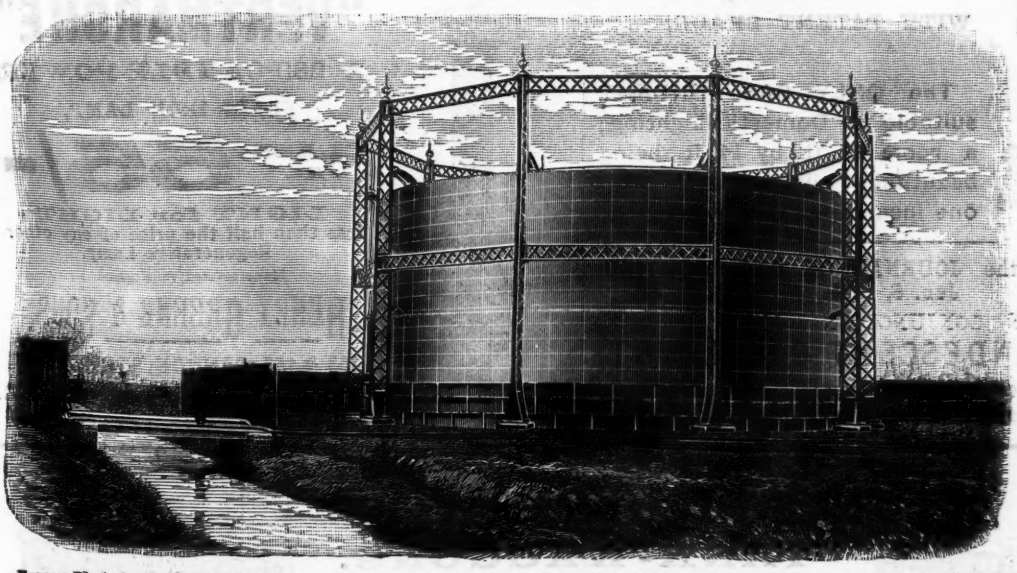
LAMP SERVICE CLEANER.

R. DEMPSTER & SONS, Ltd.,

ROSE MOUNT GAS ENGINEERING WORKS,

ESTABLISHED 1855.

ELLAND.



From a Photograph of an 80 feet Telescopic Gasholder in a Cast-Iron Tank, erected by us, with Excavation and Foundation, in 1893.

Gasholders and Tanks.

Valves.

Rotary and Reciprocating Exhausters.

Purifiers.

Scrubbers, &c., &c.

CONTRACTORS FOR EVERY DESCRIPTION OF

GAS PLANT AND CONSTRUCTIONAL IRONWORK.

ENQUIRIES SOLICITED.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

OSLER,
BIRMINGHAM.
MANUFACTURERS
OF GASELIERS
IN GLASS AND METAL.

ESTABLISHED 1861.

JOHN BROTHERTON, LIMITED,
IMPERIAL TUBE WORKS,
WOLVERHAMPTON,
MAKERS OF
TUBES AND FITTINGS
FOR EVERY PURPOSE.
PLEASE APPLY FOR LISTS. Telegrams: "IMPERIAL, WOLVERHAMPTON."

BEST & LLOYD
MAKERS OF **BIRMINGHAM.**
THE
PATENT "SURPRISE" PENDANT,
WITH PATENT SHADE.

The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

Extract from the JOURNAL OF GAS LIGHTING, Jan. 8, 1895.
"IN CONJUNCTION WITH
THE INCANDESCENT GAS-LIGHT,
it quite **supersedes** the familiar three-light pendant. We are able to bear witness to the **convenience** of the New Pendant."

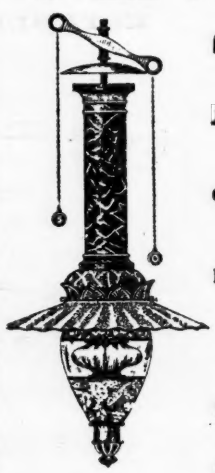
BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

PETTIGREW'S PATENT
Sulphate of Ammonia Plant
ON THE CONTINUOUS SYSTEM
Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.
Old Systems easily and cheaply converted.
ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.
Write for Particulars, Testimonials, and References to
GEO. PETTIGREW & Co.,
GAS AND CHEMICAL ENGINEERS,
MIDDLESBROUGH-ON-TEES.

The Climax of Regenerative Gas Lighting!!



THE
"VERTMARCHE"
A 280-CANDLE POWER PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.
HENRY GREENE & SONS,
153 & 155, CANNON STREET, LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

OIL GAS
BETTER TERMS CAN BE OBTAINED FROM SUPPLIERS OF OIL IF PURCHASERS HAVE THEIR OWN
TANK-WAGGONS.

HURST, NELSON, & Co., LTD.,
THE GLASGOW ROLLING STOCK AND PLANT WORKS, MOTHERWELL.
REGISTERED OFFICE:
27, ST. VINCENT PLACE, GLASGOW.

ALEX. C. HUMPHREYS, M.E. A. G. GLASGOW, M.E.

TELEGRAPHIC ADDRESS:
"EPISTOLARY, LONDON."

HUMPHREYS & GLASGOW,

Contracting Engineers for
CARBURETTED WATER GAS PLANT,
9, Victoria Street, London, S.W.

United States Office:
64, Broadway,
New York.

CLAYTON SON & Co, LTD

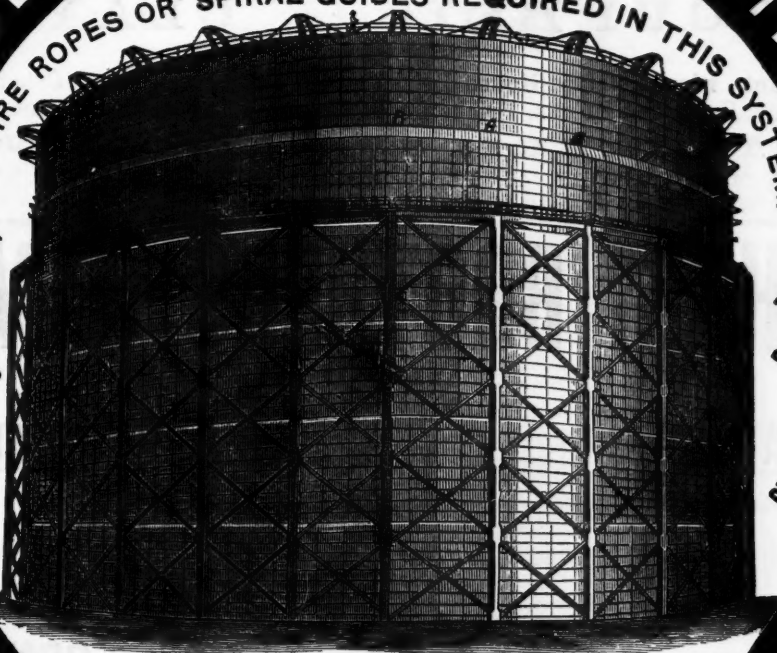
MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.

CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS.
GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

PHILADELPHIA EXHIBITION, 1876.

ALSO SILVER MEDAL, PARIS.

The Highest Award for Gas-Retorts and other Goods in Fire-Clay has been awarded to KING BROTHERS for their Goods made from their renowned Stourbridge Fire-Clay.

KING BROTHERS,

Proprietors of

STOURBRIDGE CLAYS,

Manufacturers of

Fire-Bricks, Tank Blocks, Glass-House Bricks and Pots, Gas-Retorts, Crucibles in Clay and Plumbago, Gas-Oven Bricks, Bricks for Regenerator Furnaces and Hot-Air Stoves.

STOURBRIDGE, ENGLAND.

CRUCIBLE MANUFACTORY, 46, PENN STREET, CURZON STREET, BIRMINGHAM.

N.B.—Gas, Blast-Furnace, and Glass-House Bricks and Glass-House Pots always in Stock, or made on the Shortest Notice.

CLAPHAM BROTHERS, LIMITED,

ESTABLISHED 1837

LARGE REPEAT ORDERS

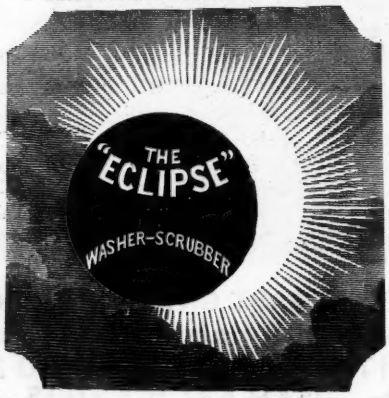
Have been received for

Laycock & Clapham's Patent

"ECLIPSE"

WASHER-SCRUBBERS.

Order Early.



GREAT SUCCESS

OF

Clapham's Patent

"ECLIPSE"

CONDENSER.

SEND FOR PARTICULARS.

CLAPHAM'S IMPROVED VALVES, PURIFIERS, AND RETORT-FITTINGS, MAINS, AND GENERAL CAST AND WROUGHT IRONWORK.

Catalogues, New Book of Testimonials, and full Particulars on Application.

Wellington, Nelson, and Market Street Works, KEIGHLEY, YORKS.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, April 2, 1895.